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AGRICULTURE LINKAGES TO THE OIL AND GAS SECTOR IN UGANDA

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Any enquiries can be addressed in writing to the Executive Director on the following address:

Economic Policy Research Centre
Plot 51, Pool Road, Makerere University Campus
P.O. Box 7841, Kampala, Uganda
Tel: +256-414-541023/4
Fax: +256-414-541022
Email: eprc@eprc.or.ug
Web: www.eprc.or.ug

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2024

TABLE OF CONTENT

ACKNOWLEDGEMENT 3
LIST OF ABBREVIATIONS 4
EXECUTIVE SUMMARY 5
7

1. INTRODUCTION 8
2. CONCEPTUAL FRAMEWORK 9
3. METHODOLOGY OF THE STUDY 10
3.1. Desk Review of Documents 10
3.2. Quantitative Methods 11
3.3 Qualitative Methods 11
3.4. Research Quality Assurance 12
4. FINDINGS OF THE STUDY 12
4.1. Characteristics of Firms (Businesses) Surveyed 12
4.2. Estimation of Food Demand 14
4.3. Food Needs for Outsourced Labour 18
4.3.1 Food Standards 19
4.3.2 Setting of food standards 20
4.4. Sourcing of Food by the O&G Sector and Other Entities 21
4.5 Proportion and Motivation for Sourcing Locally Produced Food 22
4.6 Linkages of O&G Sector and Other Firms to Agriculture 23
4.6.1 Perception of Linkages 23
4.7 Support Services to Linkages 26
4.7.1 Wholesale and retail 26
4.7.2 Input and service provision to agriculture 27
4.7.3 Agro-manufacturers 29
4.7.4 Employment creation and enhancement 30
4.7.5 Financial services 31
4.7.6 Other support service linkages 32
4.7.7 Opportunities and constraints to support services 34
4.8. Support to Climate Smart Agriculture 36
4.8.1 Green financing 36
4.8.2 Challenges in expanding green finance 38
4.9 Past and Present Initiatives to Strengthen Linkages 38
4.9.1 Initiatives by PAU in Collaboration with other Stakeholders 39
4.9.2 The Adequacy of Initiatives being undertaken to Harness Linkages 40
4.9.3 The interventions required to ensure that linkages areharnessed 40
4.10 Long terms Impacts of the Oil and Gas Sector 41
4.10.1 Employment 41
4.10.2 Shift of Labour from Agriculture 42
5 CONCLUSION AND RECOMMENDATIONS 43
5.1 Conclusion 44
5.2 Recommendations 45
REFERENCES 46
APPENDICES 47

LIST OF FIGURES

Figure 1 Interlinkages between OG and agriculture sector 9
Figure 2 The annual food demand and supply during the Exploration stage 1 of the O&G activities; 2005-2012 (000 tonnes) 16
Figure 3 Annual food demand and supply in Stage 2- O&G exploration activities ('000 tons) 16
Figure 4 The annual food demand and supply during the Development stage of the oil and gas activities; 2018-2020 (000 tonnes) 17
Figure 5 Food requirements for the labour sourced by commodity in the O&G and pipeline districts (%) 18
Figure 6 Linkage between oil and agriculture (%) 23
Figure 7 Perception about forms of linkage between firms and Agriculture (%) 24
Figure 8 Ways of maximizing linkages (%) 25
Figure 9 Constraints the Oil and Gas sector is facing in supporting Agriculture (%) 26
Figure 10 Preferred method of purchasing local food products (%) 27
Figure 11 Provision of inputs at household level (%) 28
Figure 12 Perception of linkages between O&G sector and agro-manufactures sector (%) 29
Figure 13 How is the Oil sector establishing linkages between O&G and agro-manufactures? 30
Figure 14 Preparation to tap into the petrochemical industry (%) 30
Figure 15 Barriers to joining the petro-chemical industry (%) 31
Figure 16 Actors offered financial services (%) 31
Figure 17 Extent of financial service linkages (%) 32
Figure 18 Way in which oil and gas is supporting Agriculture (%) 33
Figure 19 Value chain stage with the highest potential to maximize gains from the oil and gas sector (%) 33
Figure 20 Opportunities in the O&G and Agriculture linkage (%) 34
Figure 21 Constraint to linking farmers in both O&G and pipeline regions (%) 35
Figure 22 Support to the development of climate-smart agriculture (%) 36
Figure 23 Past initiatives to strengthen linkages between agriculture and oil and gas (%) 39
Figure 24 Adequacy of initiatives implemented to harness linkages (%) 41
Figure 25 Skills outsourced and their proportions (%) 42
Figure 26 Extent to which the oil and gas sector has impacted Export development (%) 42
Figure 27 Drivers of export development (%) 43

LIST OF TABLES

Table 1 Characteristics of Firms Surveyed expressed in percentage (%) terms 13
Table 2 Direct Demand by O&G companies (Annual Volumes) 14
Table 3 Estimated Food Demand in Oil Activity Regions and by Respondents in Ug. Shs. Billion 15
Table 4 Food Standard Currently Expected by Migrant Labourers (%) 20
Table 5 Source of Food for Migrant Workers, by Type of Food (%) 21
Table 6 Motivation for purchasing local food by Type of Food (%) 23
Table 7 The value of services provided by the surveyed firms in UGX billions 29
Table 8 Shift of labour across sectors 42

APPENDICES

Appendix T1: Firm population 55
Appendix T2: Sample and response rate of firms 56
Appendix B1: Calculation of sample probabilities and weights 56
Appendix T3: Coverage of the FGDs and KIIs 57
Appendix T4: The annual food demand and supply during the different stages of the O&G value chain (UGX Billions) 57
Appendix T5: The food requirements for the labour sourced by region and commodity (%) 58
Appendix F1: The Exploration stage 1 of the O&G activities (2005-2012) (UGX Billions) 58
Appendix F2: The Exploration stage 2 of the O&G activities 2013-2018 (UGX Billions) 59
Appendix F3: Development stage of the O&G activities 2018-2020 (UGX Billions) 59
Appendix F4: Projection of Production stage of O&G activities 2021-2030 (000 MT) 59
Appendix T9: Product categorization of available Green Finance Loans 62

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LIST OF ABBREVIATIONS

aBi Finance	Agri-Business Initiative Finance
AIDA	Agro-economic Impact Deepening
ASEL	Australian Standards for the Export of Livestock
ASSP	Agriculture Sector Strategic Plan
CPFs	Central Processing Facilities
CNOOC	China National Offshore Oil Corporation
CODEX	Codex Alimentarius (Food Code)
CSA	Climate-smart agriculture
EAC	East Africa Community
EACOP	East African Crude Oil Export Pipeline
EP	Exploration and Production
EPRC	Economic Policy Research Centre
FGD	Focus Group Discussions
FID	Final Investment Decision
FIs	Financial Institutions
GDP	Gross Domestic Product
IRAS	Integrated Revenue Administration System
KIIs	Key Informant Interviews
LED	Local Economic Development
NDP	National Development Plan
NSD	National Supplier Database
NSDS	National Service Delivery Survey
O&G	Oil and Gas
PAU	Petroleum Authority of Uganda
PSU	Primary Sampling Unit
PPPs	Public Private Partnerships
PWC	Pricewaterhousecoopers
Q-Mark	Distictive mark of product certification
SSU	Secondary Sampling Unit
TPDC	Tanzania Petroleum Development Corporation
UBoS	Uganda Bureau of Statistics
UNBS	Uganda National Bureau of Standards
UNOC	Uganda National Oil Company
UNPS	Uganda National Panel Survey
WBES	World Bank Enterprise Survey

EXECUTIVE SUMMARY

A. Background

Uganda is in advanced stages of developing its oil sector. Key investments are expected in not only production, but also in the related infrastructure namely 12 tarmacked roads covering over 500km; an International Airport in Hoima; oil-related industrial park; Central Processing Facilities (CPFs); crude oil and petroleum products storage facilities and transmission hubs; and logistics warehousing and offices.

Estimates suggest that such investment are over US$ 10 billion in the medium term. In addition, it is projected that intensification of the various investment and development activities will attract close to one million people to the Oil & Gas and pipeline Regions; and that this, in turn, will create huge demand and market opportunities for food products in the oil regions and beyond. Therefore, the various O&G developments have the potentials to unlock strong linkages with and stimulus to the country's agriculture sector.

Agriculture plays a dominant role in the livelihoods of most Ugandans. More than two-thirds of Uganda's population is engaged in the agricultural sector and the sector contributes about 24% of the country's Gross Domestic Product (GDP). In addition, agricultural products account for a significant portion of Uganda's foreign exchange earnings, and these products contribute the largest share (71%) of merchandise exports.

Therefore, it's imperative that Uganda urgently formulates and implements interventions to harness and strengthen vital linkages between agriculture and the O&G sector. Importantly, however, whereas requisite interventions must be informed by concrete evidence, systematic studies have not been carried out to evaluate and define the interlinkages between Uganda's O&G and agriculture sectors. This gap requires that pertinent studies are undertaken to explore the various linkages between the two sectors, and to evaluate how these linkages can and should be harnessed in the short, medium and long-term periods.

B. Objective

Against the above, this study was instituted to establish an understanding of the sectoral linkages between the O&G and agricultural sectors in the two oil Regions of Uganda, with the goal of defining and identifying the key linkages that should be urgently addressed. The four-step study process entailed: (i) identifying and defining potential linkages between agriculture and the O&G sector; (ii) cataloguing and assessing current interventions to support the linkages; (iii) assessing the adequacy of initiatives being undertaken to harness the linkages to boost food supply; and (iv) estimating the potential impacts of the two sectors on each other and on the overall national economy.

C. Methodology

The study utilises a desk review of pertinent documents such as national-level policies, plans, strategies, and budgets; performance reports; and development literature related to the agriculture and O&G sectors. The quantitative methods utilised descriptive analyses of 3 waves of the Uganda National Panel Survey (UNPS) collected by UBoS, and the 2018 National Service Delivery Survey (NSDS) report. Lastly, A firm (business) entity survey was also conducted in 2022 to generate information used to supplement the secondary data obtained from the desk reviews.

To further examine and gain comprehensive appreciation of the linkages between agriculture and the O&G sector in

the two study Regions, key informant interviews (KII) and focus group discussions (FGD) were undertaken to collect additional data covering districts, food value chain actors, the O&G sector, and other service providers. Pre-coded and emerging themes were synthesized to enable generation of information to complement those obtained from the UNPS and NSDS analyses and the firm surveys carried out earlier.

D. Results

1. The three (3) strongest linkages between agriculture and oil sector are purchasing of food (48 percent), sale of food products (22 percent) and service provision to agriculture (12 percent). The commonest actors in the linkages are farmers (41 percent), produce traders (28 percent) and transporters (11 percent). This evidence suggests that most forms of linkages are in primary and secondary activities; and less of tertiary activities (services or processing oriented). The impediments to linkages between agriculture and oil and gas sector are limited coordination between O&G players (45 percent), limited road infrastructure (13 percent), and limited farmer organization (11 percent).
2. The cost of quality fertilizer, pesticides and fish preservatives are high. While state intervention to provide input credit through ACDP programme was beneficial, the programme ended prematurely. Similar efforts from the Agricultural and Animal Production Research Institute in Namulonge, which offered farmers easy access to seeds of high quality have been occasional. There is also limited provision for pasteurisers to milk farmers, which require huge funding estimated at UGX 200 million.
3. The direct demand by O&G companies will more than double from the development stage to the end of the two stages of oil production. For example, O&G companies are expected to more than double their demand for meat from 567,827 kilograms in the first year of the development stage to more than 1.3 million and 1.9 million kilograms, annually, in the production stage 1 and 2, respectively.
4. The indirect demand is dominated by households. This suggest that there is a missing market for food supplies to firms, and a scope for strengthening the linkage between agri-based firms and the O&G food market. This is because most of businesses in the O&G and pipeline Regions are small, young (less than 10 years), individually owned, seldom outsource labour and in the services sector. This is likely an outcome of limited business development is among firm in the O&G and pipeline Region. This limits demand for skilled labour and creates low resilience and continuity in the event of a major shock.
5. Estimates of annual household food demand during exploration and development of O&G activities suggest that there is an unmet demand for cereals and pulses in both the O&G and pipeline Regions. However, there is supply shortage of milk, vegetable & fruits and meat in both regions. This likely an outcome of increased demand for milk, vegetable & fruits and meat in the exploration 2 and production stage of oil. This suggests there an influx of people in the two oil Regions due to intensification of the O&G and pipeline activities. It is perceived that the demand for agricultural food production will increase dramatically in the next 5-15 years due to a population influx and oil activities.
6. The quantity of food and meat supply is increasingly being affected by drought. Other effects are those of soil degradation due to poor conservation measures. In this case, a significant proportion of food consumed is sourced from outside the O&G Region. For example, food items imported to Kikuube from other districts include eggs from various sources; Irish potatoes from Kagadi; and tomatoes, passion fruits and carrots from Fort Portal.
7. There is lack of awareness among firms on food standards. The results suggest that firms perceive that weight, in kilograms, is the guiding principle in the quality of food expected. Weight explains 38 and 28 percent of food selection criteria in O&G and pipeline districts, respectively. Business have not developed the level of sophistication to understand or demand standards. Moreover, the products grown by most farmers do not respond to demands in the oil camps. Most farmers grow cassava and sweet potatoes yet oil camps demand vegetables. Other common requirements are supplying tomatoes in plastic containers,

washing potatoes and washing off pesticides before supplying. Therefore, there is a scope to sensitise businesses owners on standards and on what is demanded is very important.

8. The requirement to register on the NSD is constraining firms from tapping into linkages between the two sectors. Firms are expected to have a TIN and a URSB registration, among other requirements, to register on the NSD. Most of the firms in the two regions are registered with local governments and do not have the ability to register with URA and URSB.
9. There is a wide knowledge gap on green- finance among potential clients at the grassroots and even financial institutions. Moreover, green financing competes with traditional loans. Consequently, institutions are worried about losing their client base, due to conflict of interest. Moreover, banks make profit by selling the traditional loans. There need to examine this aspect because it can potentially negatively impact green loan uptake.

E. Recommendations

1. Critical ways of maximizing agriculture and oil sector linkages are infrastructure, market information and skill development are the critical ways of maximizing Agriculture and oil sector linkages. These infrastructures include storage and processing facilities and importantly community feeder roads that are critical to link farmers to markets. Others are cooling and storage facilities, value addition equipment and skilling.
2. Overall, there is a scope to deepen the distribution of fertilizers, pesticides, improved seeds, and farm machinery at both household and farm levels in the O&G and pipeline regions. There is a scope to also increase the provision of services such as agricultural advisory, non-extension training, credit, linkage to local markets and value addition. There is also a need for a deliberate effort to de-risk agriculture through the provision of fertilizers, pesticides, and irrigation.
3. Develop the capacity to raise the quantity and improve the quality of suppliers to cater for the increasing direct demand. Capacity development can be in form of credit provision, and training in ability to demand and supply standards.
4. There is need to provide business development services to firm to able to exploit the linkages between agriculture and oil sector. Business development services may be provided through creation of business clusters. Business training and other administrative support to build awareness about O7G activities can be provided through these clusters.
5. Uganda National Bureau of Standards (UNBS) should articulate and disseminate required food standards, to create awareness, which enables adaptation and implementation among local producers. This will leverage UNBS resources and capacity to enforce standards.
6. The PAU in collaboration with local governments should support the creation of strong farmer organisations to enhance linkages and build complementarity, in disseminating information, technology, standards, access to credit, provision of extension services, market linkages, inputs, and coordination of farmers.
7. There is need for holistic approach to increase awareness on green -financing. This should not be limited to financial institutions, but also extended to development organizations and research institutions to address the knowledge gap. In addition, there is need to develop specific products to address climate change, mitigation, and adaptation.

1. INTRODUCTION

When Uganda announced the Final Investment Decision (FID) for its crude oil production in February 2022, key sector stakeholders committed to investing USD 10 billion in the country's Oil and Gas (O&G) sector. These commitments affirmed the country's set target of implementing projects in the production stage of the O&G value chain.[1] The key investment targets are the Tilenga and Kingfisher O&G projects in Buliisa, Nwoya, Hoima and Kikuube districts- hereafter referred to as the "*O&G Region*"; and the East African Crude Oil Export Pipeline (EACOP) to extend from Hoima to Tanga (Tanzania) that will traverse the districts of Hoima, Kikuube, Kakumiro, Kyankwanzi, Mubende, Gomba, Sembabule, Lwengo, Rakai and Kyotera- hereafter collectively referred to as the "*pipeline Region*".

Besides the above primary investments, Government intends to build a 60,000-barrel-per-day refinery to address the country's needs for crude oil products, such as diesel, petrol, aviation fuel and kerosine, and to spur development of related petrochemical industries and businesses. Various supporting infrastructural projects are also being developed, including 12 tarmacked roads covering over 500km; an International Airport in Hoima; oil-related industrial park; Central Processing Facilities (CPFs); crude oil and petroleum products storage facilities and transmission hubs; and logistics warehousing and offices.

It is projected that intensification of the various investment and development activities will attract close to one million people to the O&G and pipeline Regions; and that this, in turn, will create huge demand and market opportunities for food products in the oil regions and beyond. Clearly, therefore, the various O&G developments have the potentials to unlock strong linkages with and stimulus to the country's agriculture sector.

Agriculture and O&G are two of the key sectors identified in Uganda's Third National Development Plan (NDP III)[2] that will spur economic transformation and development. Agriculture, in particular, is recognized as the sector with the most significant potential to harness the opportunities and benefits that will accrue from the O&G sector. This is because agriculture plays a very dominant role in the livelihoods of most Ugandans. As examples, more than two-thirds of Uganda's population is engaged in the agricultural sector (UBoS, 2021), and the sector contributes about 24% of the country's Gross Domestic Product (GDP) (UBoS, 2021a). In addition, agricultural products account for a significant portion of Uganda's foreign exchange earnings, and these products contribute the largest share (71%) of merchandise exports (UBoS, 2021).

Research from other countries, [Klueh *et al*. (2014) on Sao Tome Principe; Fathi (2014) on Iran; and PWC (2018) on Nigeria], demonstrate strong relationships between the O&G sector and agricultural livelihoods, incomes and poverty alleviation challenges for oil-producing countries. In the case of Uganda, anecdotal evidence suggests that there are persistent challenges constraining exploitation of the various linkages between the two sectors. These range from limited skills, low agricultural production and productivity, poor coordination of agricultural value chain players and low market competitiveness. In addition, linkages between the two sectors are affected by poor adherence to production practices; low input standards and quality; inadequate financing, with lack of easily accessible long-term credit; inadequate transport infrastructure; poor coordination and implementation of policies; and the emerging adverse effects of Climate Change.

Given the above challenges, it is imperative that Uganda urgently formulates and implements interventions to harness and strengthen vital linkages between agriculture and the O&G sector. Importantly, however, whereas requisite interventions must be informed by concrete evidence, systematic studies have not been carried out to evaluate and define the interlinkages between Uganda's O&G and agriculture sectors. This gap requires that pertinent studies are undertaken to explore the various linkages between the two sectors,

1 Total Energies EP Uganda, Uganda National Oil Company (UNOC), CNOOC Uganda Limited, and Tanzania Petroleum Development Corporation (TPDC).

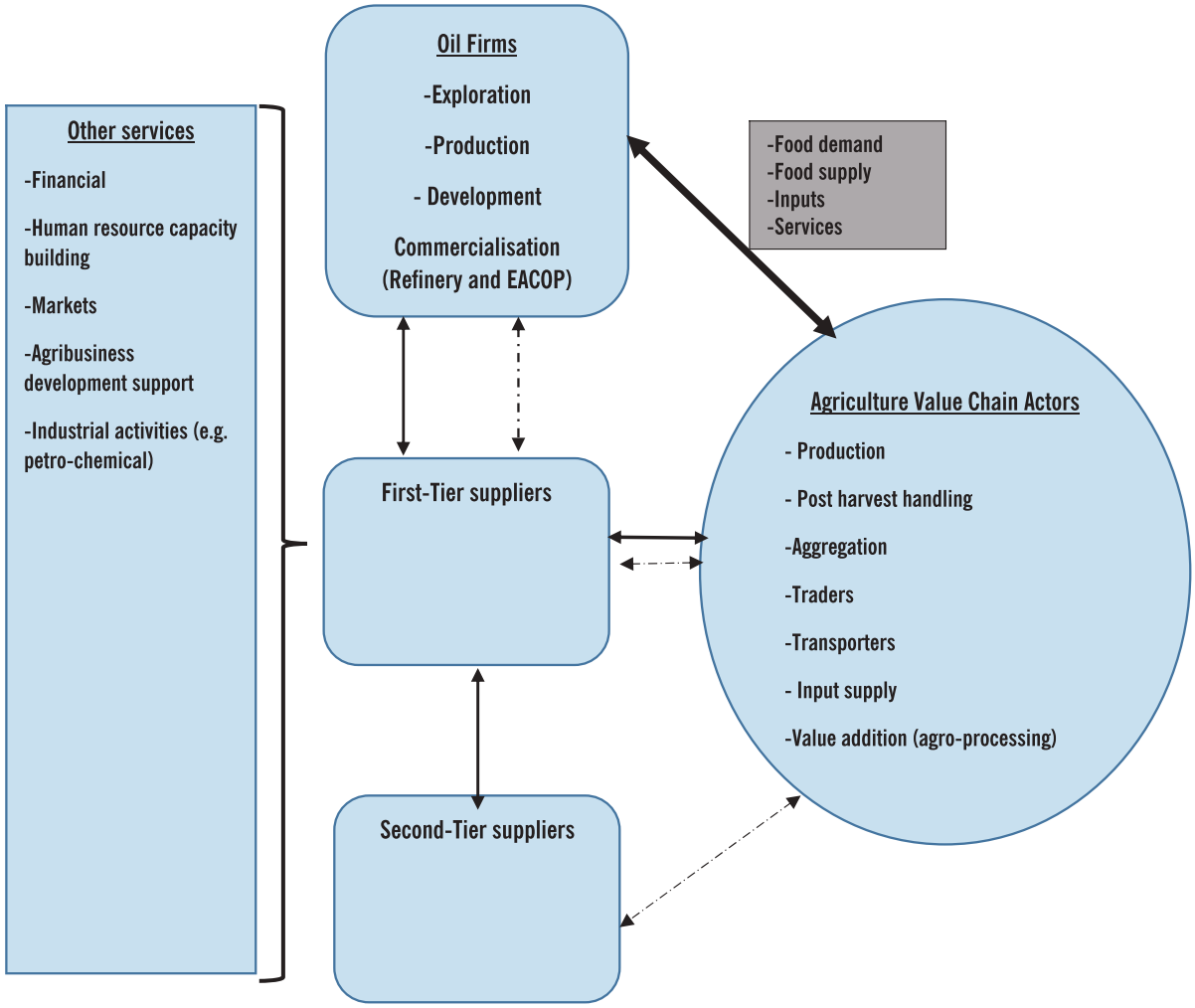
2 Other sectors include education, transport, tourism, health, land use planning and housing.

and to evaluate how these linkages can and should be harnessed in the short, medium and long-term periods. Against the above, this study was instituted to establish an understanding of the sectoral linkages between the O&G and agricultural sectors in the two oil Regions of Uganda, with the goal of defining and identifying the key linkages that should be urgently addressed. The four-step study process entailed: (i) identifying and defining potential linkages between agriculture and the O&G sector; (ii) cataloguing and assessing current interventions to support the linkages; (iii) assessing the adequacy of initiatives being undertaken to harness the linkages so as to boost food supply; and (iv) estimating the potential impacts of the two sectors on each other and on the overall national economy.

2. CONCEPTUAL FRAMEWORK

The conceptual framework used to examine the linkages between O&G and the agriculture sectors, adopted with modification from Oyejide and Adewuyi (2011), is presented in **Figure 1**. The framework was designed to capture activities undertaken at each stage of the value chain in each sector, and the inter-sectoral links or interrelations between the various activities and the value chain actors (ibid). In addition to the activities and the interrelations, service provision and supplies also form the basis of existing linkages and potential linkages or linkage opportunities, so these too were captured in the framework.

Figure 1 Interlinkages between OG and agriculture sector



Source: Conceptual framework for linkages adopted with modification from Oyejide & Adewuyi (2011)

Agriculture is linked to the O&G sector through production, value addition and aggregation, among other activities. On the other hand, the O&G sector is linked to agriculture through oil exploration, production and development activities. Linkages between the O&G and agriculture sectors are thus initiated through established relationships among sector players and their needs, activities and demands. In the conceptual framework (**Figure 1**), there are direct and indirect linkages between agriculture and the O&G sector. The Framework identifies direct linkages through demand for food by the O&G sector; supply of food by the agricultural sector; provision of agricultural inputs and other agricultural technologies by the O&G players; and service provision, such as extension and technical advisories by stakeholders.[3] In the framework, these direct linkages are shown in bold lines.

On the other hand, the indirect linkages are relationships between first-tier and second-tier suppliers in the O&G sector, but relationships between first- and second-tier suppliers with agricultural value chain actors may also exist. The first-tier suppliers are firms that service oil companies in fabrication and construction;[4] while the second-tier suppliers are firms that supply materials or inputs to the first-tier suppliers. In the framework, these indirect linkages are shown by dotted lines (**Figure 1**).

Also analysed in this study were the first- and second-tier supplier interrelations were also analysed with focus on potential linkages or spillovers that they may have beyond O&G, such as with agricultural value chain actors. The assumption is that both first-tier and second-tier suppliers exhibit direct and indirect linkages with local agricultural value chain activities. Like with oil and gas firms, the direct linkages manifest in terms of demand and supply of food, right from the entry stage of such firms through to their operations and exit. In addition, these firms indirectly render support services, such as training and provision of inputs, to the agricultural sector players through connections from O&G firms or directly after establishing contacts on the ground with agricultural sector players. Accordingly, and as conceptualized in **Figure 1**, these firms were also included in the analyses in a way that ensured that all potential linkages (indirect or direct) that could be established were captured and not missed.

The conceptual framework further takes into consideration linkages that can be established by providing other services, such as financial services, climate-smart agriculture, inclusion of youth, women and other marginalised groups, and agribusiness development services that cover financial service linkages or linkages to services targeting agribusiness development, whether direct or indirect. The framework was also formulated to capture demand-induced service provision including those at grassroot levels, such as services stimulated or established through O&G sector-related activities. These are grouped under the "other services" segment **(Figure 1**) located in the first box on the left-hand side. The framework also captured the interrelations and linkages of third-tier suppliers with the agricultural value chain.

3. METHODOLOGY OF THE STUDY

This section presents a summary of the analytical processes used in the study which included desk review of pertinent documents, and qualitative and quantitative research methods applied in the field. It also outlines justifications for, and evaluation made of the key elements of the sector linkages and related variables, as well as the quality assurance mechanisms for the study. The area of the study the *O&G and pipeline Regions*. The detailed methodology is in appendix.

3.1. Desk Review of Documents

The desk reviews were primarily undertaken to gather information for the development of the research survey tools. The documents reviewed include national-level policies, plans, strategies and budgets; performance reports; and development literature related to the agriculture and O&G sectors. To benchmark with experiences elsewhere, research reports from Nigeria,

3 Direct linkages between the two sectors is bi-directional

4 Construction includes pump assembling, pipe coating and threading firms, as well as providers of parts and materials to oil firms.

Sao Tome and Iran, were reviewed to determine possible ways of creating linkages between O&G and the agriculture sector.

3.2. Quantitative Methods

The quantitative methods utilised descriptive analyses of the various data collected by UBoS, and the 2018 National Service Delivery Survey (NSDS) report. A firm (business) entity survey was also conducted in 2022 to generate information used to supplement the secondary data obtained from the desk reviews.

Uganda National Panel Survey (UNPS): Three (3) waves of the UNPS were synchronised with three (3) phases of oil exploration, development, and production to estimate food demand and supply and possible impacts of the two sectors on the economy, especially in terms of employment, sectoral shifts of labour, and exports.

National Service Delivery Survey (NSDS): The 2018 NSDS report was analysed to establish differences usage of agricultural service, especially fertilisers and pesticides, between the oil and the pipeline Regions.

Primary data collection at the firm (business) level: As part of the study, a firm (business)-level survey was conducted in the O&G and pipeline Regions to establish institutional food demands, supply and linkages. A two-stage stratified sampling method was used to randomly pick 1,000 agricultural-related firms from a sampling frame of 15,728 firms identified in the two Regions (Appendix T1 and T2).[5] The sampling frame was constructed from two (2) sources: 1. Integrated Revenue Administration System (IRAS) database for urban districts and Manual tax files held by Sub-counties in the rural districts; and lastly; List of registered cooperatives obtained from district Commercial Officers.

During the survey 573 firms out of the total sample of 1,000 responded, which provided a response rate of 57.3 percent. The relatively low response rate was probably due to some firms changing locations and/or sector activities and many firms closing business, during 2020 and 2021, due to the COVID-19 pandemic.

3.3 Qualitative Methods

To further examine and gain comprehensive appreciation of the linkages between agriculture and the O&G sector in the two study Regions, key informant interviews (KII) and focus group discussions (FGD) were undertaken to collect additional data covering districts, food value chain actors, the O&G sector, and other service providers (Appendix T3). Pre-coded and emerging themes were synthesized to enable generation of information to complement those obtained from the UNPS and NSDS analyses and the firm surveys carried out earlier.

Key Informant Interviews (KIIs): The key informants were purposively sampled to ensure adequate representation of the agricultural (production, processing and marketing) and O&G sectors (exploration, development and development) actors; and were grouped into four categories: (i) district officials; (ii) food value chain actors; (iii) the oil and gas sector players; and (iv) financial service providers (Appendix Table T3). The KIIs interviews focused on policy processes and agricultural extension and production services; food production and supply value chain patterns; food demand and consumption patterns of the players in the sector; and effects of public; private and Public Private Partnerships (PPPs) agricultural related programmes, such as the Agro-economic Impact Deepening (AIDA), on the creation of linkages between the two sectors.

Focus group discussions (FGD): The focus group discussions (**FGD**s) were conducted with farmer associations and groups; food suppliers and produce traders disaggregated by size; seed suppliers and multipliers; agro-input dealers; food processors; hotels, restaurants, and supermarkets; and other value chain actors. The purpose of FGDs was to establish the food production and consumption capacities, availability of arable land for potential use; farming practices, including improved input use; food sorting, processing and packaging practices; storage and warehousing; and agri-financing in the two regions.[6] FGDs also captured

5 Mubende was excluded because of an outbreak of Ebola there at the time of the field study.

6 Inputs include fertilizer application, irrigation, and improved seed use.

the expectations of households and firms, and how O&G activities were impacting local economic development (LED) in various parts of the two Regions. The study also identified challenges related to pollution and Climate Change associated with O&G and agricultural sector activities and assessed how they are affecting food production and diversification.

3.4. Research Quality Assurance

To ensure quality conduct and outcome of this study, both the qualitative and quantitative surveys were actively supervised by PAU staff. The team also put in place validation mechanisms to ensure timely delivery of expected outputs, and maintenance of quality of the study. On the other hand, to promote buy-in and a learning culture among key stakeholders, the research team developed avenues for continuous and effective engagement with the stakeholders throughout the study period. These quality assurance exercises also involved the research team reporting to the internal EPRC quality assurance committee, and submitting to external review processes by PAU, Stanbic Bank Limited and aBi Finance Limited technical teams, and other key stakeholders.

At completion of the various study components, data and information obtained were compiled, analysed and are here presented using various approaches. They included descriptive statistics, graphs and charts that cover the, earlier mentioned, units of study in the O&G and pipeline Regions. The significance of the findings of the study and recommendations arising therefrom are also here presented below.

4. FINDINGS OF THE STUDY

In this section, the study present the findings on the linkages between agriculture and the O&G sectors in Uganda, and the potentials the linkages hold in advancing food production in the two oil Regions and on the general economic wellbeing of the country. The broad areas covered include characteristics of firms operating in the O&G Regions; food demand and supply; sources of food, and access and quality issues; linkages of agriculture to the O&G sector, their constraints and enhancement mechanisms; and the potential long-term impacts of the O&G sector on agriculture and the general economy of Uganda.

4.1. Characteristics of Firms (Businesses) Surveyed

As a foundation for the various elements of the study, the firm (business) survey assessed the businesses related to agriculture and the O&G sectors in the oil Regions, with the findings presented in Table 1. The survey established that most of businesses in the O&G and pipeline Regions of Uganda are either from the services (77 percent) or the agri-services (5.3 percent) sectors, and most are either individually owned (85.6 percent) or are partnerships (11.6 percent) (Table 1). Relatedly, just over a third of the firms were fairly well established, having been in operation for 5-9 years (36 percent), while a similar proportion (33.4 percent) were either new or had been in existence for 4 years or less. While the relatively many firms reflect business stimulus by the O&G investments, the high proportion of firms that were both sole ownerships with few years in operation suggest the challenge of low resilience and continuity in the event of major shocks.

The majority of business managers (44.6 percent) as well as workers (45.6 percent) attained secondary level education, which presents a great opportunity to easily train them in business management and other aspects of value addition critical for tapping the inter-sectoral linkages between agriculture and the O&G sector (Table 1). Significantly, only 7.3 percent of surveyed businesses in the oil Regions outsourced labour. Of these, 89.5 percent outsourced workers from outside the Oil regions, 9.7 percent outsourced labour from other parts of the country, and only 0.8 percent have staff outsourced from beyond Uganda. This speaks to the yet undeveloped nature of the O&G sector and its limited need for skilled labour, and also to the limited financial capacities of the businesses to necessitate hire of labour from other regions.

Table 1 Characteristics of Firms Surveyed expressed in percentage (%) terms

Business Category/Sectors	O&G	Pipeline	Average
Agriculture production	3.1	3.1	3.1
Agro-processing	1.4	5.9	3.2
Agri-services	3.7	7.8	5.3
Services	91.8	83.3	88.5
Type of organisation/business			
Sole proprietorship	81.6	91.8	85.6
Partnership (purely private)	13.9	7.9	11.6
Public private partnership	2.6	0.2	1.7
Ngo/social enterprise	1.4	0.1	0.9
Other (Specify)	0.4	0.0	0.3
Sex of business owner			
Female	40.6	31.0	36.8
Male	59.4	69.0	63.2
Sex of manager			
Female	47.1	34.5	42.2
Male	52.9	65.5	57.8
Education level of the business manager			
No education	1.3	2.7	1.9
Primary education	27.2	37.7	31.3
Secondary	44.8	44.3	44.6
Above A-Level	26.6	15.2	22.2
Education levels of business owner/majority shareholder			
No education	0.2	5.9	2.5
Primary education	25.2	42.9	32.1
Secondary	45.8	31.7	40.3
Above A-Level	28.7	19.6	25.1
Years business has been in operation			
0-4 Years	34.6	31.6	33.4
5-9 Years	36.9	34.5	36.0
10-14 Years	10.8	19.2	14.1
More than 14 Years	17.7	14.8	16.5
Skill levels of majority employees			
Below primary	2.9	8.2	4.9
Primary education	33.2	45.6	38.1
Secondary education	51.6	36.4	45.6
University education	7.2	6.0	6.8
Vocational skills	5.1	3.9	4.6
Do you outsource skills or skilled workers from outside the region?			
Yes	7.0	8.8	7.7
No	93.0	91.2	92.3
Skills outsourced from outside the region/country			
Labour from outside region only	82.9	97.5	89.5
Labour from outside the country only	0.0	1.9	0.8
Both (outside the region and outside the country)	17.1	0.6	9.7

Source: Firm survey (2022).

4.2. Estimation of Food Demand

Against the expected stimulation of food needs by O&G investments in the two oil Regions, assessment was made of O&G companies, household and firms food demand and supply for the two Regions. While household and firm level demand and supply was assessed from the exploration to production stage; this was not possible for O&G companies because only estimates of development to production stages (in volumes) are available due to data limitations.

Table 2 suggest that direct demand for most food items, by O&G companies, will more than double from the development stage to the end of the two stages of production. For example, O&G companies are expected to more than double their demand for meat from 567,827 kilograms in the first year of the development stage to more than 1.3 million and 1.9 million kilograms, annually, in the production stage 1 and 2, respectively. While O&G companies in the pipeline Regions are expected to have completed their activities during the production stages, there is a significant demand for most food items in the development stage with meat (66,660 tonnes), eggs (532,800 pieces) and milk (76,800 litres) taking a significant share of food items demanded in the first year of pipeline construction.

By type of respondents, households dominate the demand for every type of food in the Oil Regions compared to demand by firms and businesses (Table 3). On average, households account for about 85 percent of the demand for all food types, with supplies obtained directly from farms. This suggests that there is a standing market for food supplies to firms, and a huge scope for strengthening the linkage between agri-based firms and the O&G food market. Such firms can perform various roles in the agricultural value chain, including producing, purchasing, selling, processing, transporting, storing, checking, and packaging (Cuddeford, 2014).

Considering demand between the two oil Regions, the pipeline districts accounted for more than one-half of the food types demanded by the O&G sector (Table 3). For example, the estimated total value of demand for cereals in the pipeline districts was UGX 405 billion compared to UGX 152 billion demand for the same product in the O&G districts. Also, the demand for meat in the pipeline districts was estimated at UGX 507 billion compared to UGX 163 billion for the O&G districts (Table 3).

The estimates of food demand generated in this study (Table 3) corroborated with an earlier observation by UBoS (2016) suggests that the combined population and socio-economic conditions of households in the pipeline districts were far better than those of households in the O&G districts. Whereas in 2016 the population in the O&G Region was projected at 775,060 people and that in the pipeline Region was projected at 1,776,767 people (Ibid), the recent report (UBoS, 2021) costed the average food consumption per adult

Table 2 Direct Demand by O&G companies (Annual Volumes)

	Development Stage		Production Stage 1		Production Stage 2	
	Oil Regions	Pipeline Regions	Oil Regions	Pipeline Regions	Oil Regions	Pipeline Regions
Meat (Chicken, duck, fish, beef, lamb, pork, etc.) (Kilograms)	567,827	66,600	1,306,002	Pipeline Activities Complete	1,959,003	Pipeline Activities Complete
Vegetables (potatoes, tomatoes, cabbage, onions, leafy greens, etc.) (Kilograms)	1,110,204	26,400	1,210,122		2,057,208	
Eggs (PCs)	48,864	532,800	53,262		90,545	
Milk (liters)	194,798	76,800	395,440		521,981	
Rice (Kilograms)	212,400	53,280	299,484		808,607	
Flour (Kilograms)	46,810	51,690	75,832		122,848	
Cooking oil (litters)	319,680	26,640	517,882		838,968	

Source: Estimates from Various O&G Company Records

equivalent in the pipeline Region at UGX 159,440/-, while that in the O&G Region was far lower at UGX 71,235/-.[7]

Estimates were also made of the extent of annual household food demand during the Oil Exploration stage 1, in the period 2005 and 2012, and findings are presented in Figure 2 while the disaggregation during the different stages is presented in Appendix T2. Specifically, supply was higher than demand for cereals, pulses, vegetables and fruits in both the O&G and pipeline Regions; while both Regions were sufficient in the supply of cereals, pulses and vegetable and fruits during the exploration stage 1.

Food demand and supply patterns in the O&G Region suggest that there is dominance of demand and supply for cereals relative to other commodities (Figure 2: Panel 1). Conversely, there is dominance in the supply of vegetables and fruits in the pipeline Region (Panel 2). In both Regions, however, there is an implied shortage of meat; while in the O&G Region there is deficit in the supply of milk.

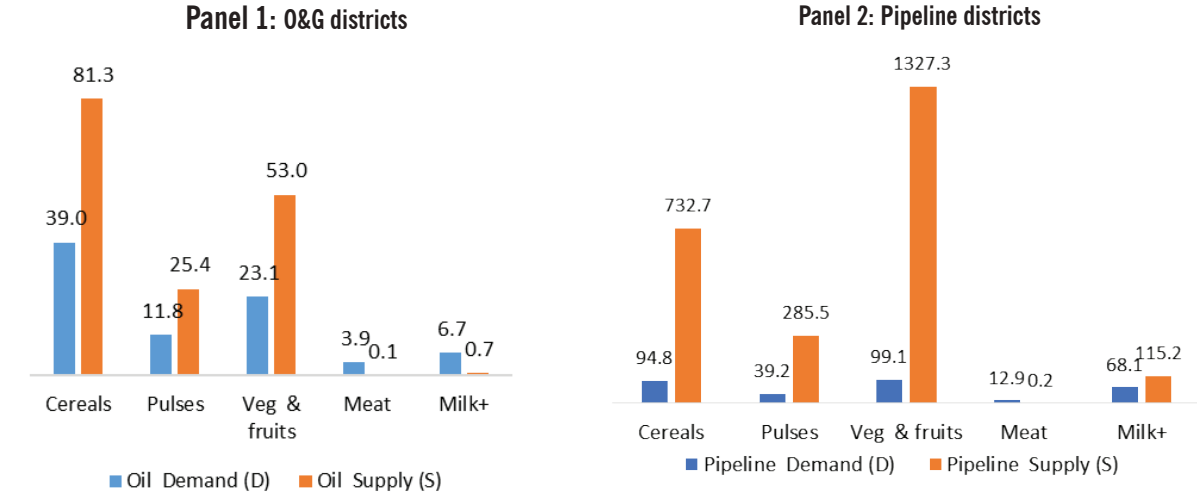
7 The average consumption per adult equivalent is calculated by taking the mean of Buganda South which represents the pipeline region. The average of Acholi & Bunyoro represents the oil & gas region.

Table 3 Estimated Food Demand in Oil Activity Regions and by Respondents in Ug. Shs. Billion

Commodity	Region	Respondents		Total	HH demand %	Firm demand %
		HH Demand	Firm Demand			
Cereals	O&G districts	152.0	18.0	170.0	89.4	10.6
	Pipeline districts	405.0	3.1	408.1	99.2	0.8
Meat	O&G districts	163.0	2.4	165.4	98.5	1.5
	Pipeline districts	507.0	20.4	527.4	96.1	3.9
Milk &Milk Product	O&G districts	40.8	3.1	43.9	93.0	7.0
	Pipeline districts	195.0	4.8	199.8	97.6	2.4
Fruits & Vegetables	O&G districts	168.0	4.0	172.0	97.7	2.3
	Pipeline districts	379.0	1.8	380.8	99.5	0.5
Pulses & Nuts	O&G districts	121.0	10.7	131.7	91.9	8.1
	Pipeline districts	291.0	3.8	294.8	98.7	1.3
Matooke & Tubers	O&G districts	181.0	7.4	188.4	96.1	3.9
	Pipeline districts	1,040.0	6.4	1,046.4	99.4	0.6
Fish	O&G districts	63.1	0.1	63.2	99.8	0.2
	Pipeline districts	142.0	0.1	142.1	99.9	0.1
Oil Seeds	O&G districts	28.9	3.5	32.4	89.2	10.8
	Pipeline districts	43.8	3.6	47.4	92.4	7.6
Eggs	O&G districts	12.2	1.0	13.2	92.6	7.4
	Pipeline districts	21.6	3.0	24.6	87.8	12.2

Source: UNPS (2019) and Firm survey (2022).

Figure 2 The annual food demand and supply during the Exploration stage 1 of the O&G activities; 2005-2012 (000 tonnes)

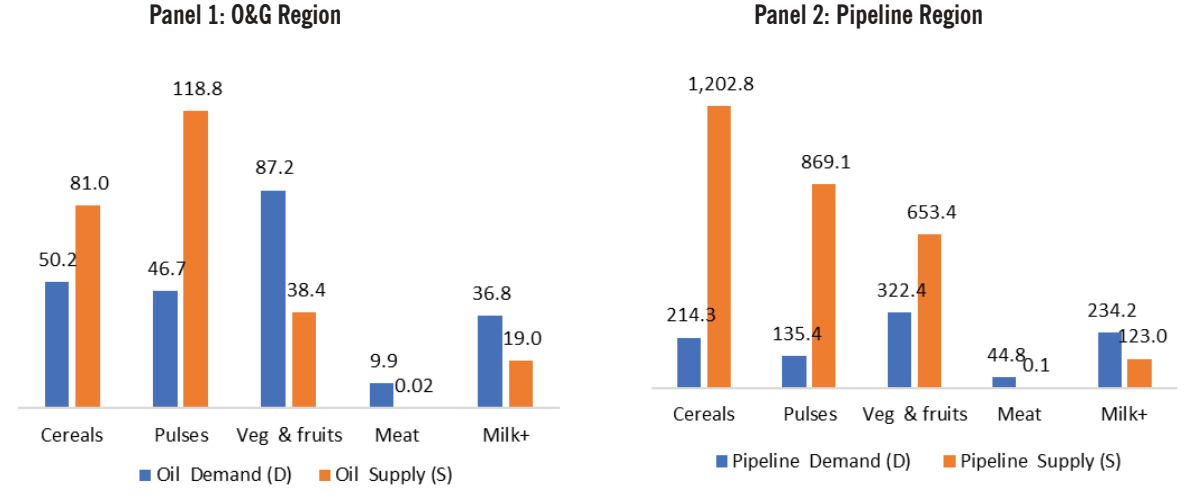


Source: EPRC's computation based on the UNPS data

The outcome of the assessment of changes in food demand during the Oil Exploration stage 2, i.e. the second phase of oil exploration from 2013 to 2017, is presented in Figure 3; while data from disaggregation during the different stages is provided in Appendix T3. Overall, annual demand for all the food commodities increased during the second oil exploration phase (Figure 3). This suggests an influx of people in the two oil Regions due to intensification of the O&G and pipeline activities. The commodity disaggregation data also suggests that the demand for vegetables and fruits increased in the O&G Region (Panel 1), while supply declined significantly. There was however high supply of vegetables and fruits in the pipeline Region, which offers an opportunity for trade in the commodity between the two Regions (Panel 2). The findings also suggest increase in the production of pulses in the O&G Region during this stage. The increase was largely attributed to changes in taste and preferences, and concomitant changes in farming practices and/or land-use.

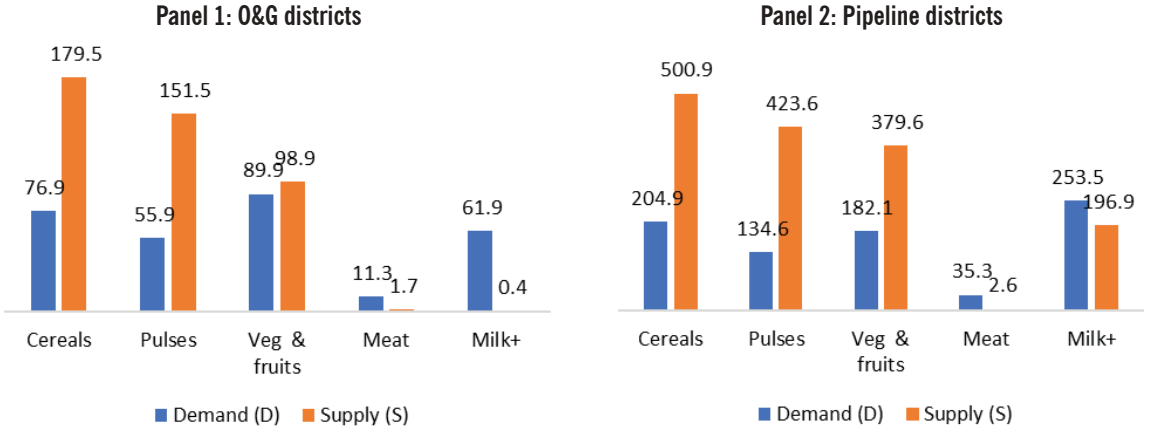
From Figure 3 and the disaggregation during the different stages provided in Appendix T2, oil exploration

Figure 3 Annual food demand and supply in Stage 2- O&G exploration activities ('000 tons)



Source: EPRC's computation based on the UNPS data

Figure 4 The annual food demand and supply during the Development stage of the oil and gas activities; 2018-2020 (000 tonnes)



stage 2 was also marked by significant increase in the demand and supply of milk. This was considered to have arisen from the deliberate investments made by Government and the private sector in the two Regions. Government is known to have provided to this Region cattle and milk cooling equipment, and also catalysed the creation of milk-related cooperatives and farmers' groups, and undertook capacity building.

Analyses of the food demand and supply situations in the oil Regions during the Oil Development phase (2018-2020) are presented in Figure 4, with the disaggregation during the different stages provided in Appendix T3. The supply of cereals, pulses, vegetables and fruits increased more than tenfold from the oil exploration stage 1 to the development stage. The demand for meat and milk also increased substantially, while supply remained low. From the analyses, therefore, there is an unmet demand for beef in the pipeline Region valued at up to UGX 0.5 trillion, while available supply was valued at UGX 37 billion only. This disparity shows a wide scope for improving the supply of meat through support to local production systems in both the O&G and pipeline Regions.

Although there were deficits in the supply of vegetables and fruits in the O&G Region during the oil exploration stage 1 and stage 2, the overall demands for vegetables and fruits remain unmet. Based on the Monte-Carlo simulation of the 5 and 10 year forecasts of volumes of demand and supply,[8] the demand for vegetables and fruits in the O&G Region is expected to grow from 89,000 tonnes in the development phase (Figure 3: Panel 1) to 158,000 tonnes in the first phase (first 5 years) of production (Figure 4: Panel 1) and 270,000 tonnes in the 10 years second phase of production (Figure 4 Panel 2).

For cereals the simulation projects that, in the pipeline Region, the demand for cereals will increase from 204,000 tonnes in the oil development phase (Figure 3: Panel 2), to 341,000 tonnes in the first phase of oil production (Figure 4: Panel 3) and 615,000 tonnes in the second phase of oil production (Figure 4: Panel 4). While in the O&G Region the demand for cereals is expected to grow most, from 180,000 tonnes in the oil development phase (Figure 3: Panel 1), to 317,000 tonnes in the first 5 years of oil production (Figure 4: Panel 1) and 539,000 tonnes in the second 10 years phase of oil production (Figure 4: Panel 2). Similarly, in the pipeline Region, cereals represented the biggest growth in demand from 501,000 tonnes in the oil development phase (Figure 3: Panel 2) to 854,000 tonnes in the first phase of oil production (Figure 4:

8 In forecasting future volumes, we first, calculated the mean and variance of the change volume by crop based on historic data through year t. We forecast volumes by 5 (Production Phase I) and 10 years (Production Phase II) into the future. The forecasts are generated with repeated random draws from a normal distribution, with drift and variance equal to the one that we earlier generated in the previous steps. We simulate 50 different forecasts of the future for each crop category. For example, to calculate a volume for the year 2020, we forecast 50 different crop volume paths for volume in the years 2020 to 2030. In the last step, we take averages across the volumes from the 50 different paths to determine the expected Volume for each of the crop categories.

Panel 3) and 1,503,000 tonnes in the second phase of oil production (Figure 4: Panel 4).

In contrast, the supply of milk and meat is still suppressed in both production phases in the O&G Region. While the supply of meat in pipeline region is equally subdued in same periods. This forecast suggests that there is an opportunity to export cereals, pulses and vegetables in both regions and an opportunity to invest in the supply milk and meat in the O&G Region, and meat in the pipeline region.

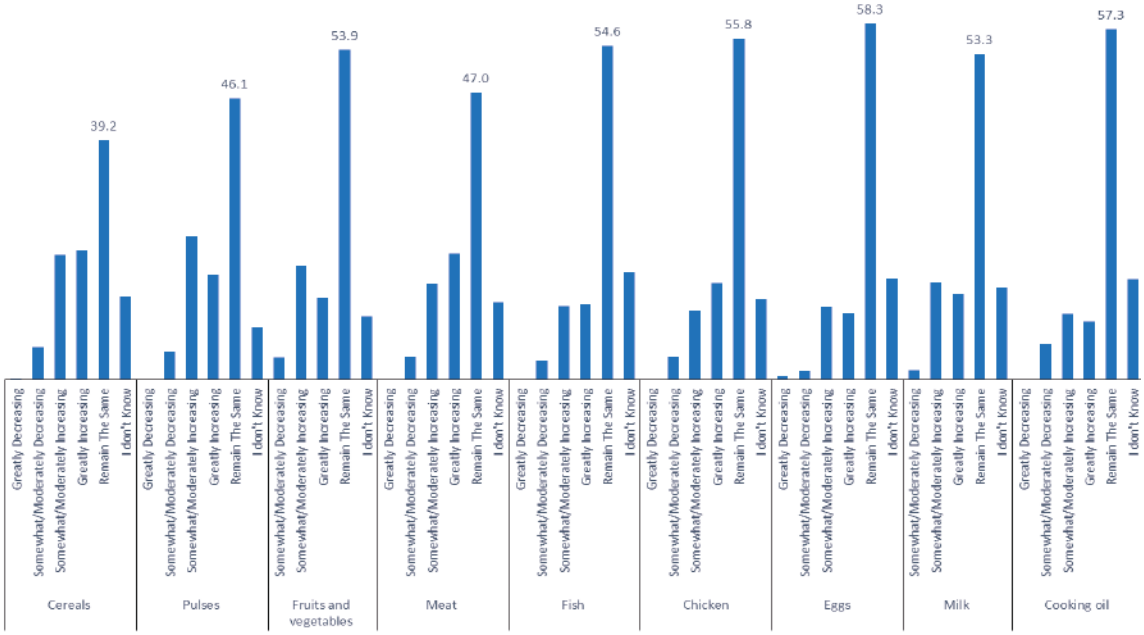
4.3. Food Needs for Outsourced Labour

Figure 5 shows that more than one-half of all the respondents in the O&G and Pipeline districts perceive that demand for most of the products by outsourced labour will remain the same except for meat (47.0 percent) and cereals (39.2 percent) and pulses (46.1 percent) which have a low demand (A regional disaggregation is provided on Table A5 in the appendix). The absence of change in demand by outsourced labour is consistent with Table 1, which suggests that less than 10 percent of skills were outsourced from outside the region. However, it is perceived that the demand for agricultural food production will increase dramatically in the next 5-15 years due to a population influx and oil activities. Yet, supply lags behind demand (District officials in the O&G Region, 2022).

In addition, the quantity of food and meat supply is increasingly being affected by drought. Other effects are those of soil degradation due to poor conservation measures. Furthermore, given the proximity to a national park, wild animals such as elephants are also contributing to crop destruction in the O&G Region. A key informant illustrates the challenges of expanding agriculture in the region.

> *"While Kikuube can provide food for its current population, there is no food security because farmers (in Kikuube) are scattered. In addition, people resorted to growing sugarcane instead of rice. Even worse, forests have been destroyed for permanent settlement. Consequently, due to the influx of the population, "matooke" (cooked banana) is solicited from Ankole and rice from Northern Uganda. …. Kakumiro has the potential to supply the food quantity needed. However, there is no irrigation system, yet the districts have water bodies sufficient*

Figure 5 Food requirements for the labour sourced by commodity in the O&G and pipeline districts (%)



Source: Firm Survey (2022)

to sustain this system" (District officials in the O&G Region, 2022).

Key informants confirm the earlier mentioned shortage of horticulture and surplus of cereals in the O&G districts. In this case, a significant proportion of food consumed is sourced from outside the region. Food items imported to Kikuube from other districts include eggs from various sources; Irish potatoes from Kagadi; and tomatoes, passion fruits and carrots from Fort Portal. It was distinctly noted during the study that:

"There is an increase in demand for vegetables. Previously, fish was a staple; but now vegetables are part of the diet."…."However, limited weather forecasting initiatives, fake fertilisers and seeds, soil fertility deterioration, poor quality aquacades, and increase in drought… are likely to limit the quantity produced to meet the food demands of emerging oil and gas activities". (District official in the O&G Region, 2022).

4.3.1 Food Standards

Table 4 presents a breakdown of food standards expected by the current cohort of migrants in both the O&G and the pipeline districts. The results suggest that firms perceive that weight, in kilograms, is the guiding principle in the quality of food expected. Weight explains 38 and 28 percent of food selection criteria in O&G and pipeline districts, respectively. The inability to meet this requirement is due to the high post-harvest losses as reported in the O&G Region.

"Poor storage facilities reduce weights", District officials in the O&G and pipeline districts (2022).

Evidence from elsewhere suggests that the choice of weight as the overriding attribute means that most of the current migrant workers come from lower-income, lower-skilled, and informal segments of society. These lower-income households rate weights (and affordability) as the most important food attribute, as opposed to their higher-income counterparts who prioritize food based on food toxicity and organicity highly (Duvenage, Schönfeldt & Kruger, 2010).

Nevertheless, sanitary and phytosanitary conditions (15 percent), hygiene in production (9 percent) and organic foods (8 percent) were also cited by firms as food attributes expected by migrant workers in the O&G region. Meanwhile, preparation standards (16 percent) and sanitary and phytosanitary conditions (16 percent) and toxicity (11 percent) are the second best-valued food attributes among migrant workers in the pipeline region. The evidence above indicates that migrant workers are unaware of other standard attributes. This not a surprise as weights are consistently cited as a key standard attribute in both regions under review. In addition, and as mentioned on Table 1, most of the businesses in the O & G and pipeline districts are small, not older than 9 years, owned and managed by persons with no more than a secondary school qualification, and have less than 10 percent outsourced labour. It follows that such business have not developed the level of sophistication to understand or demand standards. However, there is a scope to sensitise businesses owners on standards.

"Standards demanded by the O&G sector, as talked about, are applied unfairly and mainly to locals. For the set standards, there is no manual, no training has been done on set standards, and what to expect or not, there was no involvement of the locals in setting food standards," District officials in the O&G region (2022).

However, there are areas where standards are being enforced. For example, there are initiatives to ensure milk quality standards are met in Sembabule District.

"Milk producers are required to test for adulteration, such as added sugar, water, and urea," Milk processor in the Pipeline region (2022).

Table 4 Food Standard Currently Expected by Migrant Labourers (%)

Standards	Oil districts	Pipeline districts
Weights	37.9	27.6
Prequalified	7.7	1.0
Toxicity	4.2	10.7
Organic	8.3	1.2
Non-organic	0.1	0.1
Traceability	0.1	8.6
UNBS compliance	8.0	8.0
Sanitary and phytosanitary	15.3	15.8
Food preparation standards	4.5	16.3
Production technique	0.4	0.9
Inputs used organic fertilizer	0.0	0.2
Storage facility	3.9	0.6
Transportation safety	0.4	0.5
Hygiene in production	9.1	5.1
Others	0.1	3.5
Total	**100.0**	**100.0**

Source: Firm Survey (2022)

4.3.2 Setting of food standards

During the survey, it emerged that oil companies do not set food standards. Standards are set by UNBS on demand. Normally, national standards take precedence. However, where national standards do not exist, international standards may be adopted. There have been cases where companies have used choice standards.[9] In cases where there are no standards, PAU makes a request to UNBS to develop those standards in consultation with stakeholders. However, standards are ongoing processes of learning and can be modified when new information becomes available.

> *"Standards are demand driven. If PAU finds the standards that are very crucial, they write to us and we begin the discussion on what is required to develop those standards. We usually bring people of interest together to develop standards"* (Standards Regulator 2023).

It also emerged that oil companies do not buy food directly; they hire contractors to deliver food which must meet national food standards governed by UNBS. The process of hiring contractors is competitive and is advertised in the media, with food specifications outlined in the advertisement. Some companies set a monthly menu which determines what is needed and procured from suppliers. Other companies also rank sub-contractors by ability to meet specifications. For example:

> *"Tier 1 suppliers - meet all the requirements and tick all the boxes. Tier 2 supplier- meets 60-70% of requirements. Finally, Tier 3 suppliers are community suppliers in the Albertine region. They rarely meet the standard, but we have to work with them. We assist them to scale production to a level that is acceptable."* (Contractor 2023)

Generally, the process of standards development starts with a presentation from a user on the problem at hand. The second stage involves the constitution of a technical committee of industrial experts, academia, traders, manufacturer and representatives of consumers. The third stage reviews existing standards, if no Ugandan standards exists, a review EAC standards will commence. In cases where there is no EAC standards, then ASEL or CODEX will be adopted. Typically, the CODEX standards give a foundation of standard development. However, it is usually general. Therefore, there is need for customizing it to the hygiene and safety problem at hand. The fourth stage involves gazettements of the standards and disseminating it through the media.

> *"We have public relations and do market assessment where we get customer feedback, do audits of products with the Q Mark. Industries that comply to the set standards and are put in our websites, unless they have not renewed their licenses or are in the process. We also assess consumer groups through field officers that gather feedback on product standard adherence. Through these interactions we are updated on the understanding of the standards." (Standards Regulator 2023)*

9 Choice Standards are American standards.

4.4. Sourcing of Food by the O&G Sector and Other Entities

Oil companies, PAU and other stakeholders have identified areas that can be serviced by local suppliers. Currently, 16 service areas have been identified and these are mostly in food related supply areas.[10] Sourcing food locally is essential to build local capacity and ensure economic viability. Table 5 shows the sources of food for migrant workers by type of food. The results suggest self-sufficiency in the food supply in the O&G and pipeline regions. More than 80 percent of food types are sourced within the region as shown in Table 5. By purchasing locally grown foods, migrant workers are helping to maintain farmlands in the O&G and pipeline regions.

Farmers who can profit from food production are less likely to sell land for development. Local food purchase is an opportunity to grow the local markets and reduce the environmental impact of transporting food. Local food sourcing is linked to safe food supply. However, the question is whether this local economic system can be sustained. However, it should be noted also that less than 10 percent of workers are migrants (Table 1) and that may also explain the high preference for foods sourced within the district on Table 5.

Key informant interviews with Tier I contractors reveal that all service providers (caterers) procure food locally- from the farmers in the community. Though, initially, caterers had difficulties sourcing food locally. The caterers may have had difficulties in sourcing food locally because of size of firms in the study location. Table 1 suggest that less than 15 percent of firms are partnership or companies. Most of the firms are sole proprietorships and family businesses. Moreover, the products grown by most farmers do not respond to demands in the oil camps. Most farmers grow cassava and sweet potatoes yet oil camps demand vegetables. Most farmers grow vegetables on a lower scale, not more than 2 acres, and cannot, therefore, sustainably supply contractors.

Therefore, training of farmers on what is demanded is very important. This has been partially resolved by building the capacity of local farmers, particularly through community liaison officers. Some of the common requirements are supplying tomatoes in plastic containers, washing potatoes and washing off pesticides before supplying. Equally, encouraging and facilitating farmers to register on the NSD is critical. Information of the registration requirements should also be clearly communicated.

10 The 16 supply areas are in goods, works and services

Table 5 Source of Food for Migrant Workers, by Type of Food (%)

Commodities	Cereals	Pulses	Vegs	Fruits	Meat	Fish	Chicken	Eggs	Milk	Cooking oil	Milk
Oil-districts											
Within the district	87.2	91.0	96.1	88.6	89.2	91.4	89.3	88.3	83.3	88.3	83.3
Albertine	6.9	8.0	3.5	7.6	3.2	5.2	4.7	6.0	7.5	6.0	7.5
Outside Albertine but Uganda	4.9	0.0	0.3	3.7	6.1	3.4	2.0	3.8	5.6	3.82	5.6
Another country	1.0	0.0	0.1	0.1	1.5	0	4.0	1.9	3.6	1.9	3.6
Pipeline districts											
Within the district	91.1	91.0	93.2	91.9	90.9	89.7	83.9	91.3	91.1	91.3	91.1
Albertine	4.0	9.0	3.3	7.7	5.9	9.9	10.6	8.5	8.7	8.5	8.7
Outside Albertine but Uganda	2.7	0.0	3.0	0.3	3.0	0.3	5.1	0.2	0.2	0.2	0.2
Another country	2.2	0.0	0.5	0.1	0.1	0	0.4	0.0	0.1	0.0	0.1

Source: Firm Survey (2022)

"……because the NSD registration was a major hindrance to suppliers. You can't require a person with 100 chicken to register on the NSD. We try to make exceptions, provided their goods meet the minimum standards requirements" (Tier 1 contractor, 2023).

"Firms which perceive a low linkage complain that they are first required to register with the National Supplier Database (NSD). While the NSD is a great idea, it excludes a majority of firms because a prospective registrant is required to be tax compliant with a Tax Identification Number (TIN) and registered with the Uganda Registration Services Bureau (URSB). Majority of firms in Uganda cannot meet these requirements," District official, O&G region (2022).

"……. registration with the National supplier Database (NSD) is hard for local suppliers since it requires a certificate of incorporation, tax clearance certificate, national social security clearance certificate, proof of compliance with social security requirements in the country of incorporation, a valid national identification card, and others. Ordinarily, peasant farmers, desist from wanting to know more about other opportunities in the oil sector since we cannot meet these requirements" Food processor in the O&G region (2022).

However, a tier I contractor contends that the NSD is giving local suppliers a platform to improve the quality of their products.

"Sub-contractors are required to i) have an NSD number, ii) have 70% Ugandan ownership, iii) if you have no capacity then enter a joint venture with a foreign company" (Tier 1 contractor, 2023).

4.5 Proportion and Motivation for Sourcing Locally Produced Food

The study sought to understand the share of local food in total firm expenditure. Earlier, Figure 3 suggested that the share of local food in total expenditure is increasing. However, poor farming practices could hinder the performance of the local farming system (District official in O&G region 2022). As mentioned, the demand for horticultural products such as mangoes is outstripping the supply. More importantly, value-addition capacities need to be enhanced to salvage seasonal surplus.

"There is no constant supply of quality vegetables, fruits, chicken, and eggs in Hoima city. We usually end up buying these products from Kampala as a hotel. For instance, the grapes, yellow oranges, and vegetables like cucumber, Hass Avocado, Mushrooms and processed cereals" (District official in O&G region 2022)

This study also sought to understand the drivers/motivators of local food purchases in the oil and pipeline districts. Table 6 suggests that the overall largest driver of local food purchases is freshness (29.4 percent), low transport cost (27.8 percent), low price (22.3 percent). A disaggregation suggests that low prices and low transport costs were the two main drivers for the local purchase of cereals, pulse, chicken, other foods, and cooking oil. On the contrary, freshness is a dominant attribute of the local purchase of fish, vegetables, fruits, meat, and milk. Surprisingly, quality and traceability (know where/how production) rank among the lowest attributes considered while deciding whether to purchase locally. Altruistic drivers such as supporting the local economy or supporting local farmers are largely disregarded in deciding whether to purchase home-grown products, save for the purchase of locally produced cooking oil.

Table 6 Motivation for purchasing local food by Type of Food (%)

Motivation	Cereals	Pulses	Vegetables	Fruits	Meat	Fish	chicken	Eggs	Milk	cooking oil	Total
Freshness	13.6	17.0	48.4	46.7	34.8	35.6	12.1	18.7	64.0	2.6	29.4
Know how it is grown	2.4	3.0	1.6	1.9	1.8	1.8	5.3	4.8	0.1	0.0	2.3
High Quality	5.5	5.1	0.1	0.2	1.6	0.1	2.2	3.2	1.5	3.6	2.3
Low Price	25.1	26.4	14.3	11.0	23.0	19.5	37.2	21.3	10.8	34.0	22.3
Taste	4.4	4.6	1.3	1.9	2.6	6.0	0.5	1.8	4.7	6.2	3.4
Low Transport Cost	33.3	33.4	22.2	26.4	23.6	24.1	29.5	35.7	15.4	34.2	27.8
Support Local Economy	11.7	6.1	4.6	4.6	8.6	9.9	5.4	4.7	3.0	17.5	7.6
Support Local Farmers	2.8	3.1	4.8	7.3	2.6	2.8	6.0	9.7	0.5	0.3	4.0
Other (Specify)	1.2	1.4	2.7	0.1	1.4	0.2	1.8	0.0	0.0	1.5	1.0

Source: Firm Survey (2022).

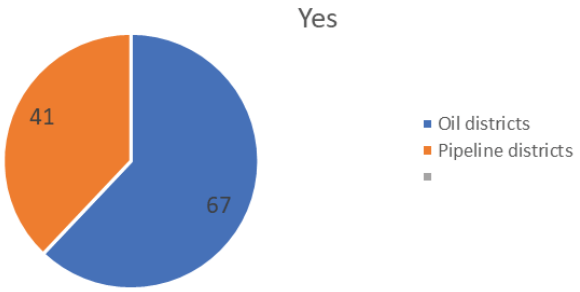
Freshness alludes to the earlier mentioned issues of inadequate storage, but in this case, cold storage. Similarly, prices are related to the ability to obtain cheap quality inputs, mitigate climate change, and address food shortages, especially the earlier mentioned scarcity in horticulture (Irish potatoes, tomatoes, passion fruits and carrots) in the O&G region. While the deficit in road coverage in the O&G regions has been addressed—especially for national roads — there is a scope to tarmac the feeder roads, which connect farmers to the market. But most importantly, the disregard for quality and the preference for cost is linked to information on Table 1, which describes the characteristics of firms as small (sole proprietorship); mostly owned by marginalized person (women) with less than secondary education certification; and mainly employing local and low-skilled labour.

4.6 Linkages of O&G Sector and Other Firms to Agriculture

4.6.1 Perception of Linkages

Figure 6 suggests that firms in the O&G region (67 percent) perceived a direct linkage between O&G and agriculture, compared to those in the pipeline (41 percent).

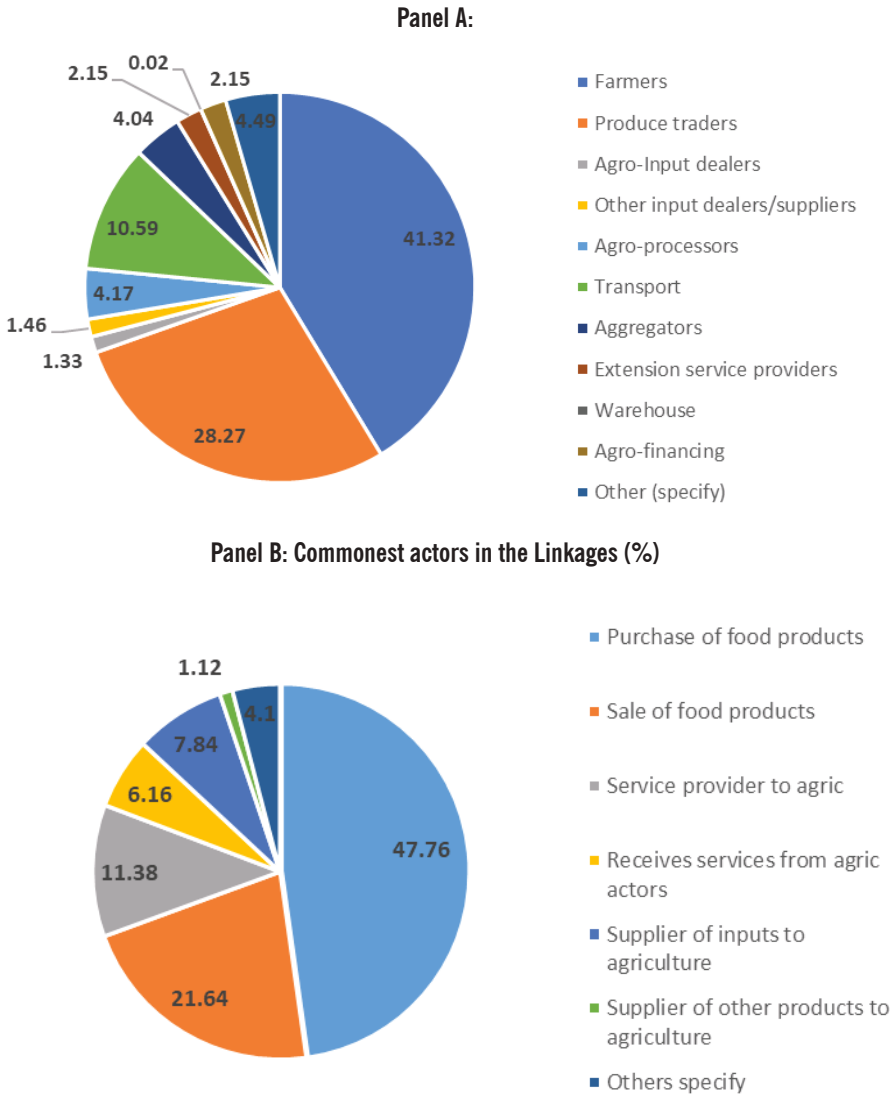
Figure 6 Linkage between oil and agriculture (%)



Source: Firm Survey (2022)

The study also attempts to establish activities and actors with the strongest linkages. Panel A of Figure 7 suggests that the 3 strongest linkages between firms and agriculture are in purchasing of food (48 percent), sale of food products (22 percent) and service provision to agriculture (12 percent). This evidence suggests that most forms of linkages are primary activities and secondary (less services or processing oriented), as evidenced in Panel B of Figure 7 where the commonest actors in the linkages are farmers (41 percent), produce traders (28 percent) and transporters (11 percent).

Figure 7 Perception about forms of linkage between firms and Agriculture (%)



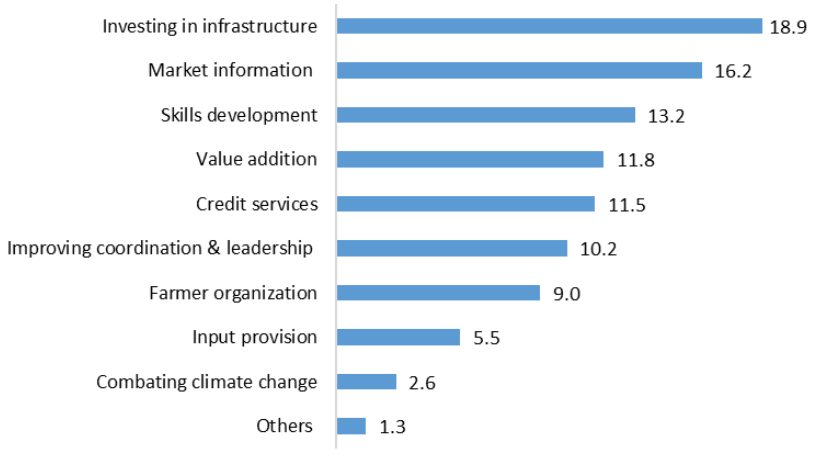
Source: Firm Survey (2022).

Indeed, Panel B suggests that only transport services (11 percent) linkages among agricultural support services are deeply entrenched. Linkages to other support services such as agro-input dealers (1 percent), other input dealers/suppliers (2 percent), agro-processors (4 percent), transport (11 percent), aggregators (4 percent), extension service providers (2 percent), warehouse (0.02 percent), and agro-financing (2 percent) are negligible. For example, it was established that the efficiency of extension workers was low.

> *A case in point is extension workers from the pipeline region who had limited or no knowledge of agronomical practices. In addition, extension workers are over-worked and poorly facilitated, which affects their motivation* (Opinion leader in pipeline regions, 2022).

Relatedly, there has been a complaint that the existing processing equipment are not appropriate or fit for purpose. For example, some of the processing equipment requires a lot of physical energy and cannot easily be operated by women (Food processors in the pipeline region, 2022). In addition, women are currently involved in primary activities such as threshing and winnowing. This alludes to the need to develop strategies that involve women in more profitable stages

Figure 8 Ways of maximizing linkages (%)



Source: Firm Survey (2022).

of the agricultural value chain such as food processing, value addition and marketing (Ibid).

Figure 8 suggests that infrastructure (19 percent), market information (16 percent) and skill development (13 percent) are the critical ways of maximizing linkages. It is interesting that the firms continue to stress the need to close the infrastructural gaps, yet many investments have been made in the last 10 years. This emphasizes existence of gaps in infrastructure such as; storage and processing facilities and importantly community feeder roads that are critical to link farmers to markets.

Roads are not the only infrastructural deficits; there is a slow uptake of other forms of infrastructure, such as cooling and storage facilities and value addition equipment. It was noted that;

> *"While women have been trained to use technology, such as processing of milk, through numerous technology uptake programmes, they have no capital to buy milk coolers."* Processors from the pipeline Region (2022).

In addition, outdated cultural norms and practices deny women access to infrastructure. For example, women are excluded from infrastructure-intensive activities which are profitable. A key informant noted that

> *"Initially, women processed milk and its products, such as ghee and Yoghurt. However, after the introduction of dairy cooperatives (with cooling facilities) and these activities became profitable, men took control of these activities".*

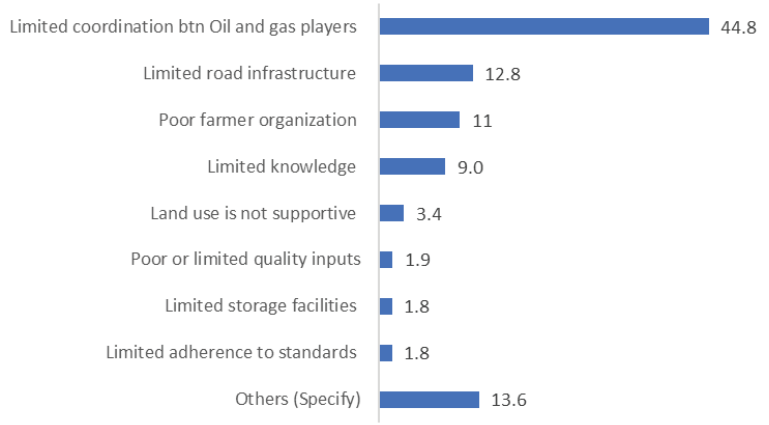
In relation to skilling, there is a strong need for more training, especially for marginalised groups such as youths and women;

> *"It is imperative to include us women and youth in the agricultural production and supply processes… our participation is still low, especially in processing and marketing production. On average, production is 70 percent women, processing about 40 percent and marketing about 40 percent or less"* (District official oil &gas region 2022)

In addition, Figure 9 suggests that limited coordination between O&G players (45 percent), limited road infrastructure (13 percent), and limited farmer organization (11 percent) are the major causes of the slow linkage between oil and gas and agriculture.

While coordination of farmer activities is key to leveraging benefits emanating from linkages between O&G and agricultural activities, the study highlighted the poor coordination and weak capacity of farmer groups to tap into the opportunities presented by the O&G sector. In some areas, weak capacity of farmer groups was also attributed to limited access to land

Figure 9 Constraints the Oil and Gas sector is facing in supporting Agriculture (%)



Source: Firm Survey (2022).

among women and youth farmers which has limited their participation in agriculture. Also, while there are some cases of success in linking farmers to markets through farmer groups and cooperatives, the O&G sector actors have largely not leveraged these networks to their full potential. As a result, off-takers buy local foods for the O&G sector at low prices, and this discourages farmers from selling to them since the farmers can get better returns selling to the local markets.

Notwithstanding, to forge linkages, contractors have tried to sub-contract community suppliers and associations. However, local suppliers have had difficulties maintaining regular supplies and prices. Contractors try to balance between inexperienced and experienced suppliers to meet demand, because community supply might be unstable. For example, Tier 3 suppliers largely supply fresh fruits and vegetables. In this case, these suppliers do not produce chicken and pork in bulk. Sometimes contractors have to source these from the bigger towns such as Hoima, Kampala, and Mubende. Whereas local suppliers also want to be paid promptly to meet their daily livelihood needs, payments, from O & G firms to tier 2 contractors, are made after every 60 days. In addition, a number of structural challenges affect suppliers for instance lack of identification;

> *"Most community suppliers don't have national IDs- making it hard for us to pay people- yet we have tax obligations. Invoicing is 60 days long, yet URA expects money every 15th of the month. So, we prefer to work with aggregators because individual farmers want cash. However Cooperatives ask for higher prices - almost 50- 60% more prices than market price. Some change the price after two rounds of supplies. We also have a problem with consistency of their supply." (Tier 2 Contractor, 2023)*

Therefore, there is a need to improve the capacity of local suppliers to develop a reliable pricing and supply mechanism. Also, a mechanism to alleviate liquidity constraints would go a long way supporting firms during periods when payments delay. Formation of SACCOs would be a good starting point.

4.7 Support Services to Linkages

4.7.1 Wholesale and retail

As noted earlier, food may be purchased directly from producers and local markets, or from firms who are bulk suppliers, wholesalers or retailers. The preference for any of these by consumers are informed by various factors, including need, resource availability, ease of access, desired quality and durability, and pricing.

Assessment of the food purchase preferences of entities in the O&G and Pipeline regions undertaken in this study is presented in Figure 10. Most firms in the O&G (44 percent) and pipeline region (52 percent) prefer to purchase food directly from farmers. Another 37 percent of firms in the O&G and 35 percent in the pipeline region purchase from the local food markets. Less than

two percent of firms buy food from supermarkets. This alludes to the earlier finding that freshness, price and transport cost are the key drivers of demand for local foods. Also, the majority of potential consumers belong to the low-income status and therefore prefer to source their food from farmers as opposed to supermarkets. This was considered to be the main reason for the low consumption of processed food in the region. The prohibitive infrastructural costs, such as electricity for value addition and cooling facilities in supermarkets, also explain why commercial stocking and processing of fresh food is low in the two oil Regions.

> *"The tariffs imposed are very high, value addition is still lacking due to limited access to technology, and there is a need to share information about market readiness" (District official in O&G Region, 2022).*

In addition, international oil companies prefer to outsource food from established Kampala-based companies such as *Pure Grow* and *MNS*.

"We have put up different structures like hotels, restaurants targeting the people who work with oil and gas, but these oil companies put up camps, and all their workers, be it local ones, are restricted to sleep in the camp and eating from there. They are not even allowed to buy a biscuit from the local shops," Food processor in the O & G region, (2022).

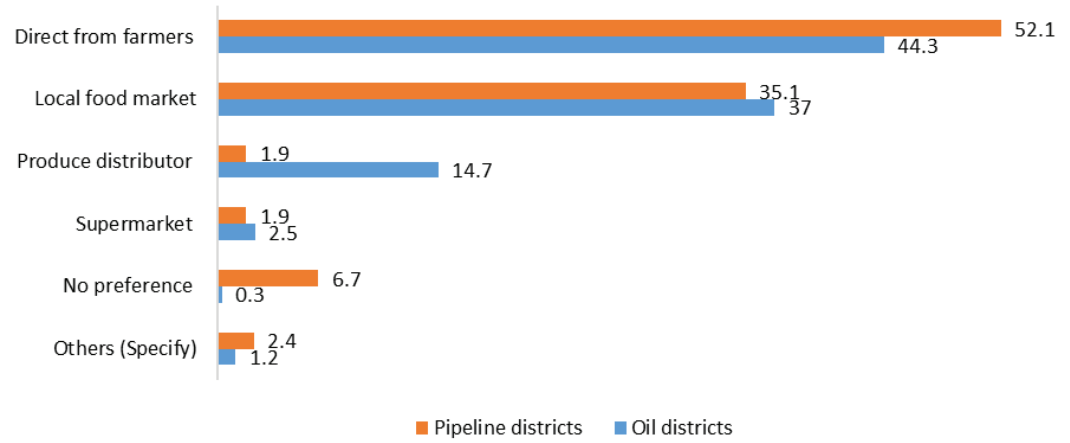
4.7.2 Input and service provision to agriculture

Panel A and B of Figure 11 present the value of goods delivered to households and firms in the O&G and pipeline regions. Panel A of Figure 11 suggests that the distribution of fertilizers and pesticides to households was negligible in both the O &G and pipeline districts. However, Panel B of Figure 11 suggests that firms in the pipeline region obtained provision of feeds and additives (UGX 29 billion) and fertilizer (UGX 6.9 billion). In the O&G region, only the provision of feeds and additives (UGX 4.3 billion) seems to be significant. Overall, there is a scope to deepen the distribution of fertilizers, pesticides, improved seeds, and farm machinery at both household and farm levels in the O&G and pipeline regions.

> *"The cost of quality fertilizer in Hoima is very high, so as a woman I have competing needs and therefore I cannot afford them. Sometime back, government under the ACDP programme gave us some inputs on credit and we would pay after harvesting, they would give us Tarpaulin and fertilisers. Their fertilizers were very good and effective. But ACDP just disappeared, we no longer see them" (Farmer in O&G region, 2022)*

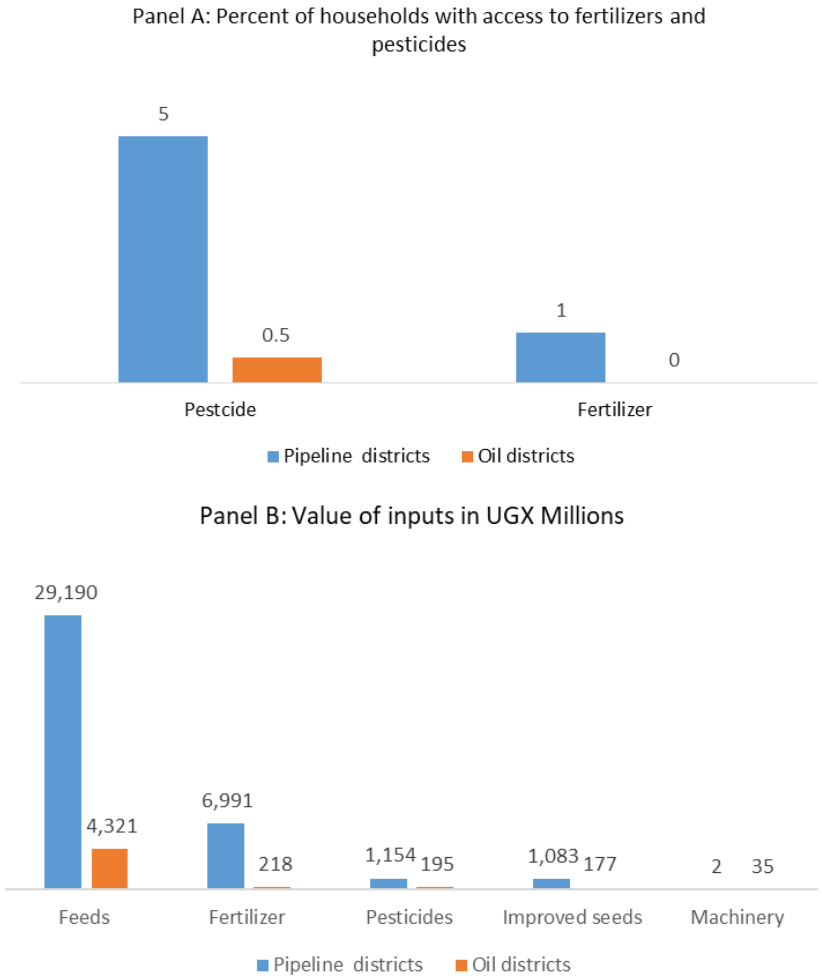
Insights on input provision reveal that initiatives of seeds by the district from the Agricultural and Animal Production Research Institute in Namulonge have

Figure 10 Preferred method of purchasing local food products (%)



Source: Firm Survey (2022).

Figure 11 Provision of inputs at household level (%)



Source: Firm Survey (2022)

offered farmers easy access to seeds of high quality. However, most farmers confirmed that the initiative is occasional, yet it's difficult for most farmers to travel to Namulonge (District Official from pipeline region, 2022).

On food preservation initiatives, *"there is a promotion of access to NARO technology for fish preservation to the majority of fish farmers"* (Fish farmers, pipeline Region 2022). They also confirmed that this adds value to the fish as opposed to sun drying and roasting because it can increase the shelf-life of fish (ibid). It was also noted that there is limited provision for pasteurisers, which require huge funding estimated at UGX 200 million (Cattle Farmer in O&G district, 2022).

Table 7 estimates the value of services provided to the oil and pipeline districts. The O&G region enjoys greater service access than the pipeline region. For O&G districts, improved access was cited as one of the key driving factors.

> *"There is good infrastructure, especially the tarmacked roads and improved markets like in Kabale, which have opened access to other regions. This has enabled farmers to access markets,"* District official O&G region (2022).

Other Services such as agricultural advisory (UGX 45 billion), non-extension training (UGX 18 billion) and credit (UGX 14.8 billion) seem to have been dominated by the O&G region. Nevertheless, services such as linkage to local markets (UGX 5 billion) and value addition (UGX 9.7 billion) are dominated by the pipeline districts.

Table 7 The value of services provided by the surveyed firms in UGX billions

Services	Oil districts	Pipeline Districts
Agricultural advisory	45.46	0.08
Trainings (Non-extension)	18.81	0.10
Credit	14.87	3.33
Saving	1.24	0.02
Linkage to financial institutions	0.68	1.16
Linkage to local markets	3.59	5.34
Linkage to export markets	0.00	0.02
Agribusiness development	0.29	0.01
Value- addition services	8.15	9.73
Water for production (irrigation)	0.00	0.00
Storage facilities	0.25	0.55
Harvesting technology	0.00	0.14
Transportation	1.53	1.10
Energy-related	0.00	0.01
Other (specify)	85.52	4.36
Regional total	180.39	25.94
Grand Total	**206.32**	

Source: Firm Survey (2022)

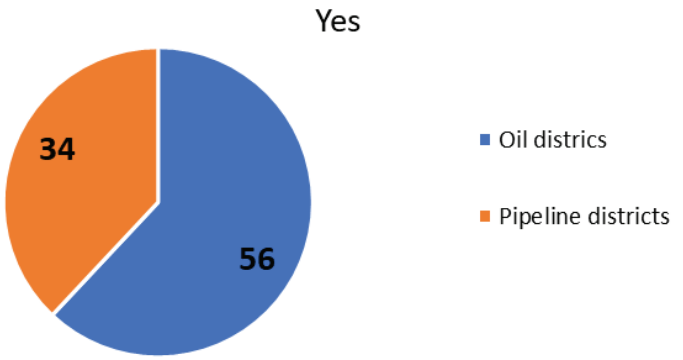
This is because unlike the pipeline region, the O&G region has benefited from oil exploration and development activities since 2006 that have accounted for more than USD 15 billion in regional investments (PAU, 2022). It is worth noting that activities to develop the EACOP project in the pipeline region commenced in 2020 and are yet to receive comparable investments.

4.7.3 Agro-manufacturers

Figure 12 suggests that 56 percent of firms in the O&G region perceive the existence of linkages between the oil and gas sector and agro-manufactures. However, few firms (34 percent) in the pipeline region perceive a linkage between the two sectors. As mentioned earlier, the O&G region has benefited more and longer from oil-related investments than the pipeline region, which may explain the relatively favourable perception.

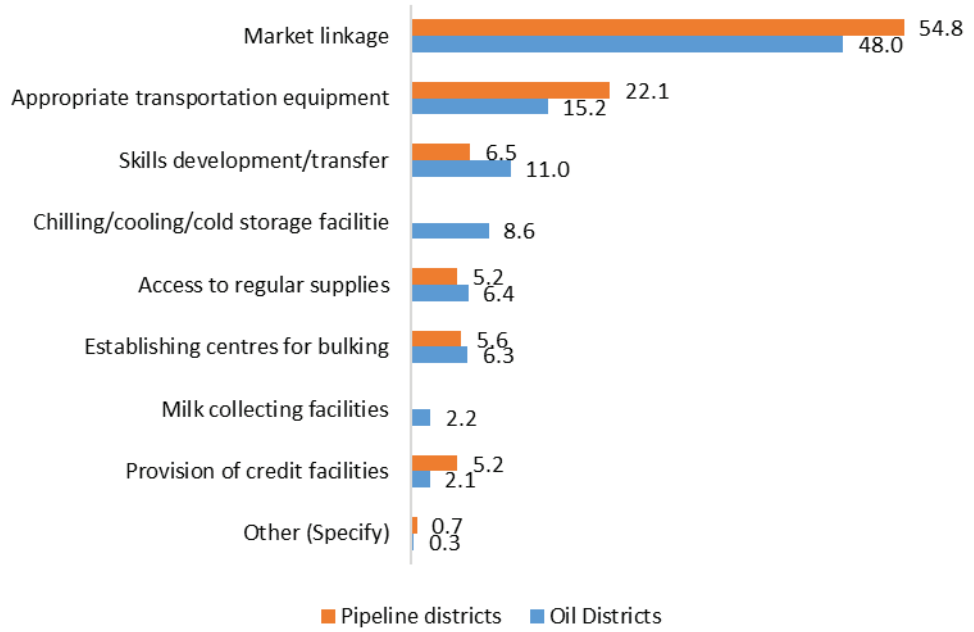
Over 70 percent of firms perceive that market linkages, appropriateness of transportation equipment and skill development were the 3 key linkages between the O&G sector and agro-manufactures sector, regardless of whether a firm is in the O&G or pipeline region (Figure 13).

Figure 12 Perception of linkages between O&G sector and agro-manufactures sector (%)



Source: Firm Survey (2022)

Figure 13 How is the Oil sector establishing linkages between O&G and agro-manufactures?



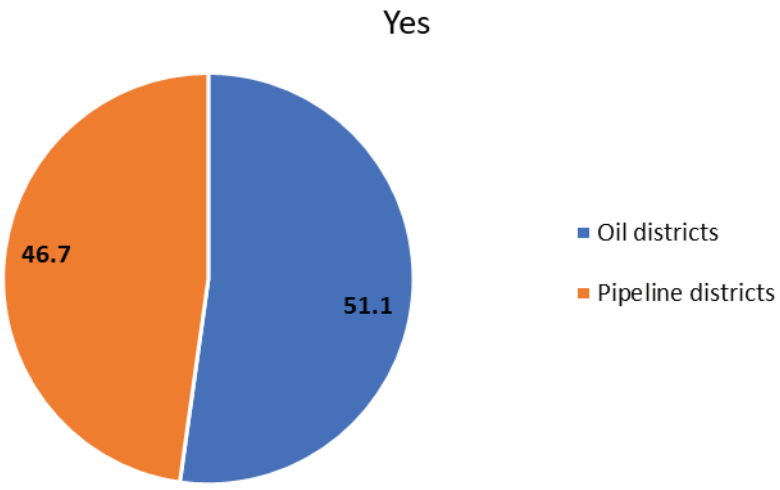
Source: Firm Survey (2022).

There are limited O&G linkages in regard to providing cold storage supplies, access to regular supplies, bulking centres, milk collection centres and credit facilities in our region. In addition, there are no silos to store cereals, which has continued to limit the preservation of harvests, which is critical for sustainable quality supplies for agro manufacturers along the pipeline region (Food processors in the pipeline region 2022).

4.7.4 Employment creation and enhancement

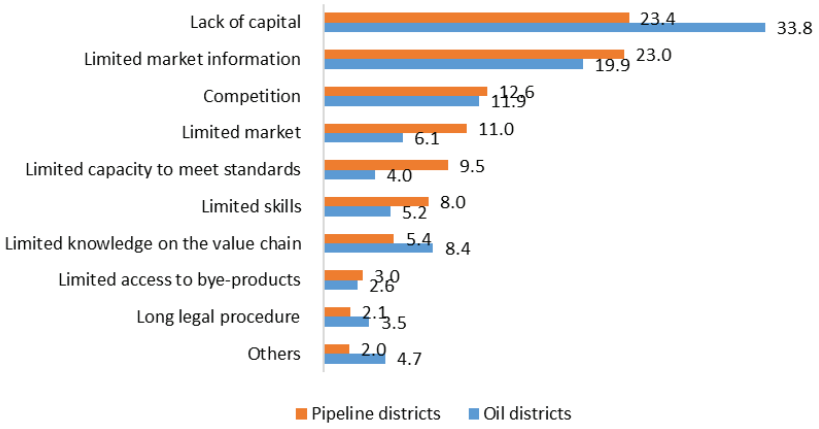
Figure 14 suggests that firms in both O&G (51 percent) and pipeline (48 percent) regions are preparing to participate in the petro-chemical industry. However, there are barriers to entry into the petro-chemical industry that may limit the number of prospective players. These barriers are typically aspects of the industry that include institutional, government,

Figure 14 Preparation to tap into the petrochemical industry (%)



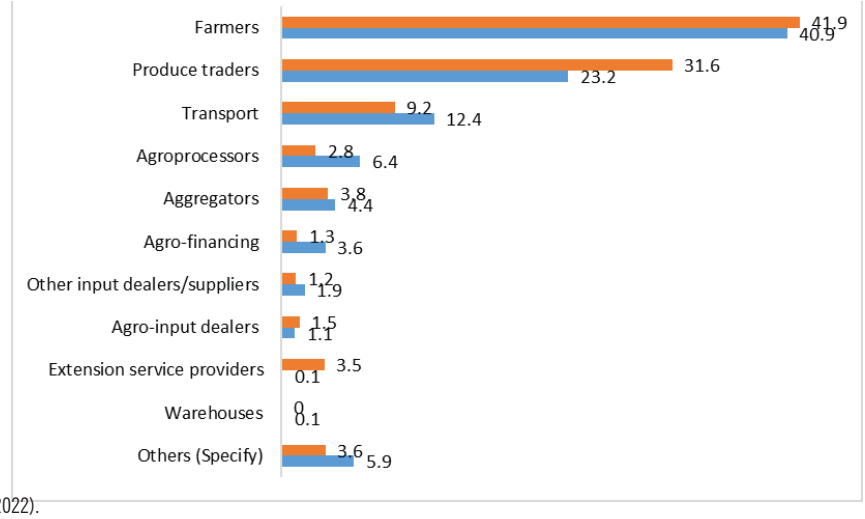
Source: Firm Survey (2022).

Figure 15 Barriers to joining the petro-chemical industry (%)



Source: Firm Survey (2022).

Figure 16 Actors offered financial services (%)



Source: Firm Survey (2022).

technological or economic restrictions on the entry of potential participants into that market or industry. Firms were asked about the types of barriers to entry into the petro-chemical industry.

Figure 15 suggests that lack of capital, limited market information and competition are the 3 key barriers that explain constraints identified by over 60 percent of respondents regardless of region. Noteworthy, lack of capital and limited market information are recurring as cross-cutting barriers to linkages other than entry into the petrochemical industry.

4.7.5 Financial services

Overall, Figure 16 suggests that firms in the O&G region have more access to finance than their pipeline counterparts. A disaggregation, and while focusing on the O&G region alone, suggests that it is mostly farmers (42 percent), producers (32 percent) and transport (13 percent) who have access to finance. This, therefore, highlights a deficit in credit access towards both regions, towards other value chain players, such as aggregators, agro- financing, input dealers, extension services, and warehouses.

However, evidence on credit disseminated by micro-finance institutions suggests that there is a variation in the type of beneficiaries. For example, food processors in the pipeline region had access to credit through Savings and Credit Cooperatives Organisations (SACCO)

"Women, aged 30 years and above, are mostly

in the food vending business mostly access credit to run their restaurants," Cooked food vendor in the Pipeline region (2022).

Furthermore, SACCOs face challenges partially related to the lifestyles of customers. For example, unstable marriages of female food vendors and producers have had a disruptive effect on loan repayment;

"When we support majority of the females in food production and cooked food vending… and they decide to start families, which disrupts their ability to repay," Financial service provider in pipeline region (2022).

Therefore, since the majority of those who access credit are women, the sustainability of the SACCOs is threatened. Consequently, SACCOs have come up with a solution on how to deal with loan default;

"To support women who are the majority in SACCOs, we promote the group loans as opposed to individual loans to guarantee repayment of the money from other members in situations where women are relocating to create families" Financial service provider in pipeline region (2022).

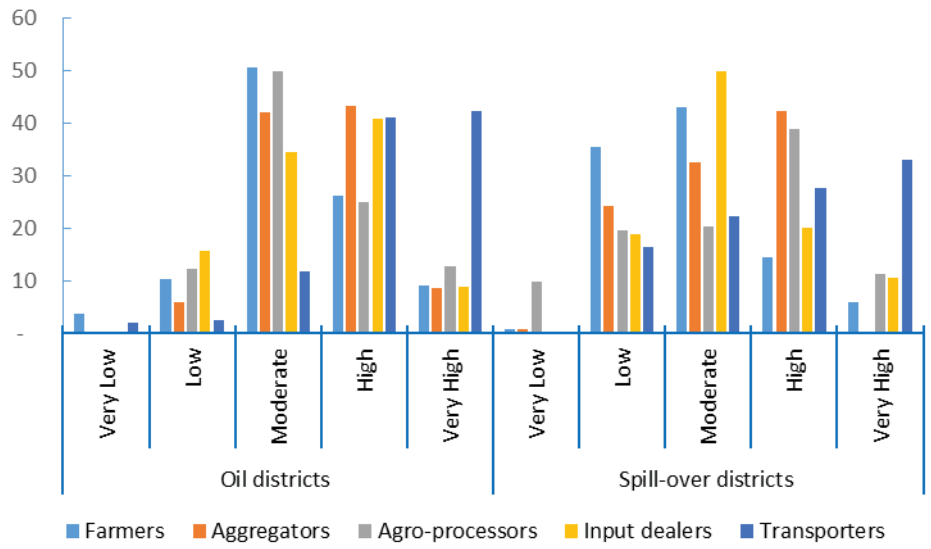
Figure 17 suggests that the extent of support to transporters, aggregators, and input dealers is broadly viewed as high in both the O&G and pipeline regions. However, the support targeting farmers is considered moderate in O&G and pipeline at 51 percent and 43 percent respectively. This is because the financial service providers consider lending to farmers highly risky due to low yields, fluctuation prices, and seasonality.

"Our SACCO offers agricultural loans to farmers at a higher interest rate of 3 percent per month compared merchandise clients at 2 percent. This is because agricultural loans are high risk as farmers are not likely to pay back because of adverse effect of climate change (floods, droughts). Relatedly, these loans are administratively expensive to monitor by our credit officers," Credit officer in the pipeline region (2022).

4.7.6 Other support service linkages

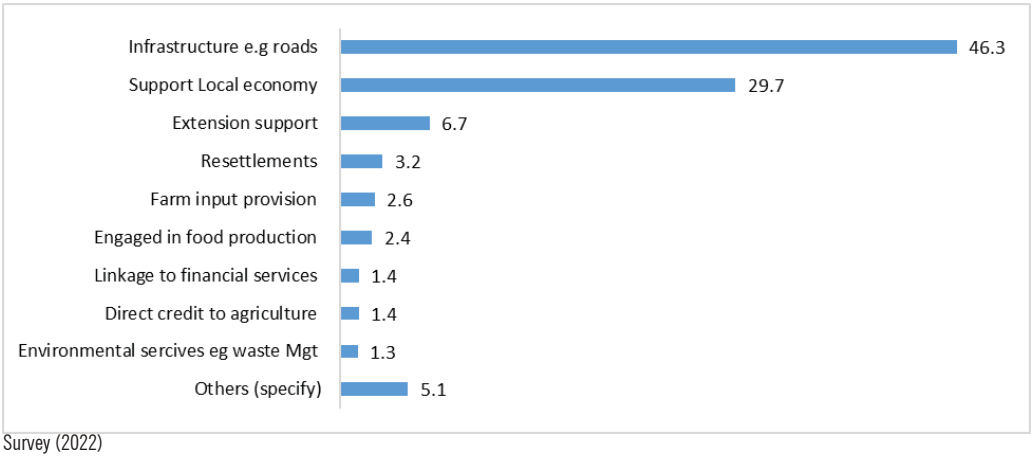
Figure 18 presents a firm perception of modalities through which the oil sector has enhanced linkages between the O&G sector and agriculture. More than 46 percent of firms believe that the O&G sector has invested in infrastructure to enhance linkages and support to the local economy. In comparison, 29.7 percent suggest that the O&G sector has attempted to create linkages through the support of the local economy. Surprisingly,

Figure 17 Extent of financial service linkages (%)



Source: Firm Survey (2022)

Figure 18 Way in which oil and gas is supporting Agriculture (%)



Source: Firm Survey (2022)

few firms perceive that O&G sector has invested in extension services (6.7 percent), resettlement (3.2 percent), farm inputs (2.6 percent), and financial services (1.4 percent) to enhance linkages.

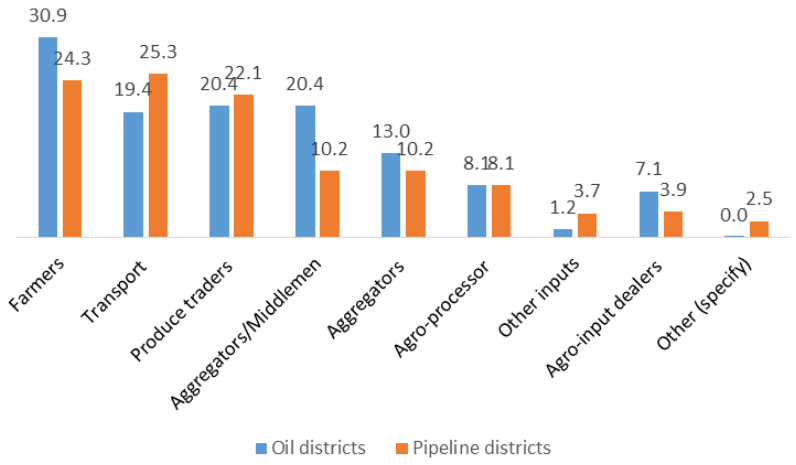
Furthermore, community sensitisations are minimal in the Pipeline districts with interest in understanding farmers' needs. However, PAU has tried to support the mobilisation of farmers into groups in the oil districts (District official in O&G region, 2022). In addition, several trainings targeting farmers are being conducted by PAU and Stanbic in both regions. However, these engagements to identify key investment areas are minimal in the pipeline region;

> *"Petroleum Authority of Uganda should make more efforts to reach communities at the grassroots, especially in the pipeline region where awareness of activities is low,"* District official in the pipeline region (2022).

As a result, this has created inadequate visibility of PAU and interaction with residents to understand how to bridge the extension services, farm inputs, resettlement, and financial services. Hence, the need for more farmers' engagement (ibid).

After identifying other linkages, exploring the ones with the highest potential is pertinent. This is important to guide investments in a resource constrained environment. Therefore, it is important to understand where the linkages can translate into the highest returns. Figure 19 presents the segments of the economy that firms perceive to have the highest potential linkages.

Figure 19 Value chain stage with the highest potential to maximize gains from the oil and gas sector (%)



Source: Firm Survey (2022)

These are supported to transport (25 percent), farmers (24 percent) and produce traders (22 percent) in the pipeline region. This ranking is consistent with that of the O&G region, except that Farmers (31 percent) were ranked higher than transport (19 percent). These findings suggest that there is a scope for participation by agriculture sector players in the identification of other investment priorities. This evidence supports the assertion that much of the current linkages between these two sectors are in primary activities. This is likely a consequence of an underdeveloped value chain. For example, there is limited access to storage facilities, processing facilities, and financial services by the value chain actors.

> *"Pest persistence, lack of capital to process harvests and buy the expensive quality fertilisers will continue to limit the quality of food produced. Similarly, Farmers lack standard food handling and storage facilities and, most times, sell their products, especially vegetables like tomatoes, cucumber, eggplant, and maize, directly from the garden."* (Food processors in pipeline Region, 2022).

Consequently, supporting farmers to access a secondary level of services is essential to strengthening linkages between agriculture and the O&G sector.

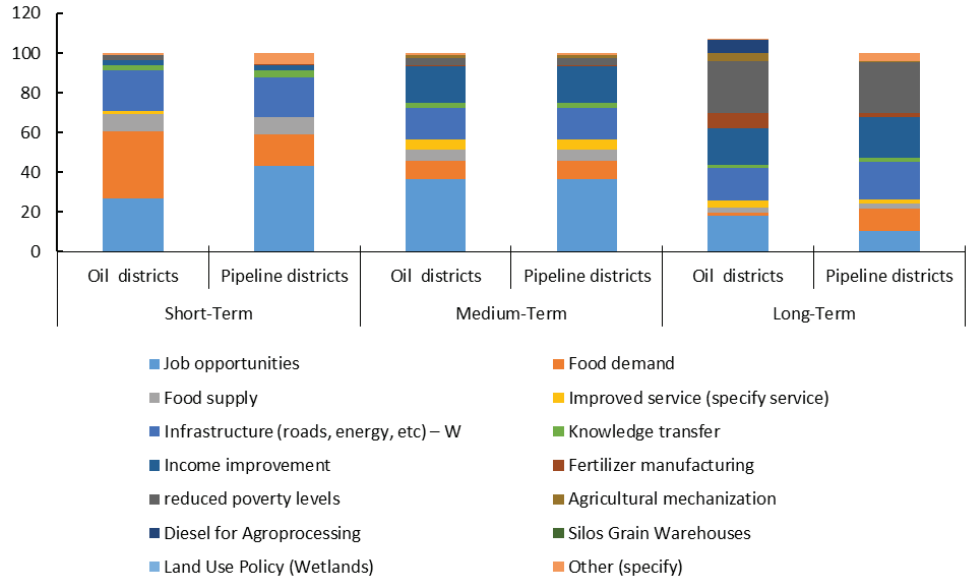
> *"Promoting agribusiness can transform the current subsistence farming with guidance on expected standards."* (District official in pipeline Region, 2022).

4.7.7 Opportunities and constraints to support services

Figure 20 partitions the expected impacts of the O&G sector on the agriculture in short-term (< 5 years), medium-term (6 < 15 years) and long-term (15+ years). In the short-term, food demand, job opportunities and infrastructure are expected by more than 80 percent of firms in the O&G and pipeline regions. In the medium-term, job opportunities, infrastructure and income improvement are expected to dominate by more than 80 percent of firms. Lastly, in the long-term, reduced poverty levels, income improvement, and infrastructure explain most of the benefits expected by more than 50 percent of firms interviewed.

The Government has made efforts to deepen the linkages between the two sectors by providing infrastructure which partially meets the expected benefits of linkages in the short term. For example, the milk value-chain is well coordinated in the O&G and pipeline regions.

Figure 20 Opportunities in the O&G and Agriculture linkage (%)



Source: Firm Survey (2022)

"There are coolers that are installed in the communities, and some of these have been installed by Government. With the organization of all producers in a cooperative, we take advantage of the coolers by paying UGX 1000/ litre for chilled milk. We also pay UGX 950 per litre for the warm milk we collect. The Individual farmers that deliver to the collection centre are paid UGX 1000 per litre; this price also compensates for their transport," Milk Processor in the pipeline region (2022)

However, other crops like maize and rice as potential agricultural enterprises in the O&G pipeline districts lack infrastructural facilitation such as warehouse, processing, and packaging. (District Official in pipeline region, 2022).

"… most times, we fail to dry all the harvest, and on using plastic sacks that are readily available on the market, our harvest gets rotten. If the Burlap sacks are reintroduced, they are aerated to keep cereals drying and can improve household-based storage of cereals" Food processor in pipeline region (2022).

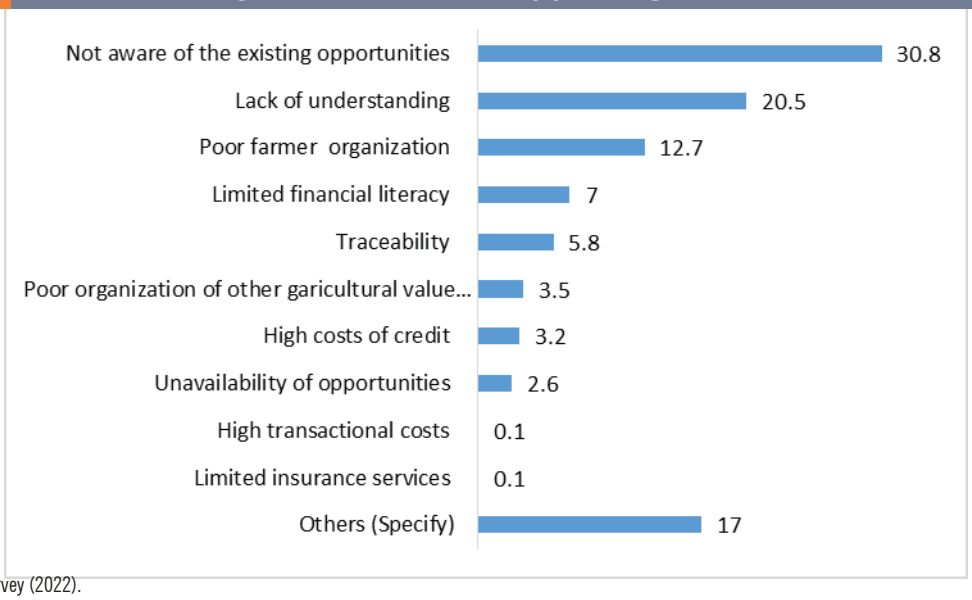
While linkages between O&G and the agricultural sector are expected to generate earlier mentioned benefits, challenges remain. Figure 21 suggests that three main challenges to these linkages are; lack of awareness of available opportunities (31 percent), lack of understanding of how agriculture works (21 percent), and poor farmer's organization (13 percent). This highlights a high degree of information gap that relates to food standards, market information, market readiness, inputs such as pesticides, herbicides, and acaricides.

"While relevant information on the required standards for locals is not accessible to understand oil companies' requirements of frozen meats (-4 degrees Celsius). Some farmers revealed that the need for standards is just a mechanism to scare suppliers," District official in O&G Region (2022).

From the above, it is necessary to tackle issues related to low awareness of linkage opportunities. It should also be noted that the three constraints are somewhat related because, as earlier stated, farmers' organisations act as channels where information can be shared among farmers. For example, extension workers can leverage farmer's groups to relay information about opportunities related to linkages.

"Extension workers can use farmer groups to disseminate information on value addition. This would expand income generating opportunities

Figure 21 Constraint to linking farmers in both O&G and pipeline regions (%)



Source: Firm Survey (2022).

along the pipeline," Opinion Leader in pipeline region (2022). "Farmer groups can also be used to register farmers for training," (ibid).

4.8. Support to Climate Smart Agriculture

The results on Figure 22 (A) show that only 6 percent of the respondents agreed to the existence of support towards climate smart agriculture in the pipeline region compared to 18 percent in the O&G region. The general perception among the respondents is that this support is low. This raises concerns, given the adverse effects of oil production and poor agricultural practices on the climate and environment, and therefore agricultural productivity and food security. This situation necessitates mitigation measures to ensure that agriculture is not negatively impacted. Consequently, investments in sensitisation about climate-smart agriculture are very critical.

"Promotion of organic farming is critical as well as urban farming; people need to be taught how to utilize small spaces in a productive way which is environmentally friendly" (CBO, 2022)

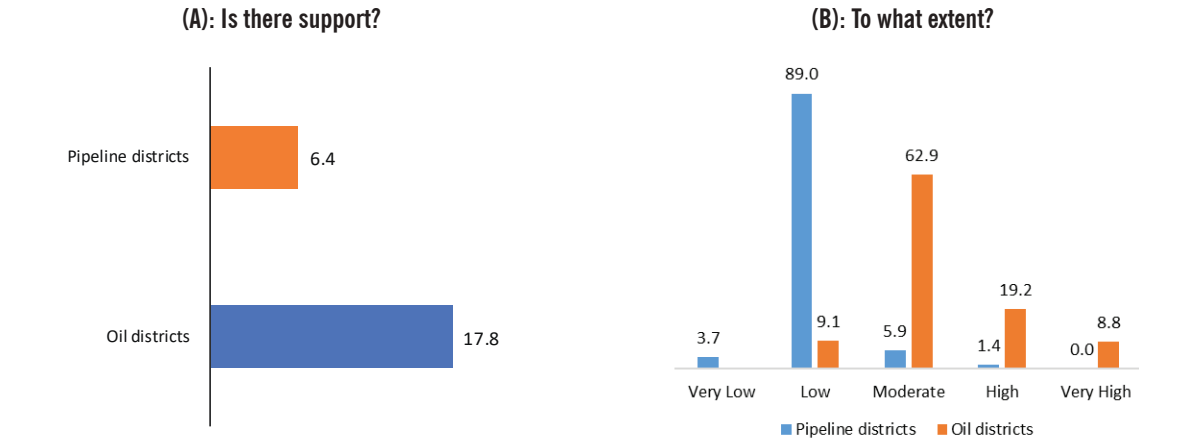
Indeed, in Figure 22 (B),most respondents (89 percent) in the pipeline region confirm that the extent of support to develop smart climate agriculture is low as compared to the O&G region where the majority viewed it as moderate (63 percent).

Largely, Key informant interviews with O&G companies reveal that they have been engaged in livelihood restoration projects-these involve working with local structurers to setup demonstration farms to support the establishment of household enterprises such as starting poultry, fishery, and livestock farming. The companies are also co-funding livelihood enterprises particularly assisting in the purchase of farming inputs. In addition, efforts are underway to support mixed farming- Agro-forestry- tree planting and preservation of degraded wetland areas. Furthermore, the companies are engaged in community training and empowerment to address elements of adaptability and sustainability of initiatives.

4.8.1 Green financing

Green financing is one of the sources that agriculture sector to leverage to strengthen the linkage with the O&G sector. From the key informants interviews conducted, we find that aBi Finance Limited is leading in enhancing green financing in all financial institutions. aBi Finance Limited is supporting most financial institutions (FIs) to on-board green finance. Given that green financing is new, and many FIs and people have minimal knowledge of going green, aBi Finance Limited needs to work out a holistic program to increase awareness. This should not be limited to FI but also extended to development organizations and research institutions. An engagement with the Tier I, II, II, and IV financial institutions indicates a growing demand for green finance loans. However, the knowledge on how green finance works deficient. More sensitization and

Figure 22 Support to the development of climate-smart agriculture (%)



Source: Firm Survey (2022).

training are required.

> *"There have been efforts in the green financing landscape to develop capacity of financial institutions through training, mainly by the Uganda Institute of Banking and Financial Services (UIBFS), to develop green financial products which would enable them to tap in to funding such as Green finance fund- UGX 124 Billion annually and Green challenge fund – UGX 12 billion this year among others."* (Banking institution, 2023).

The key informant interviews also show that green financing is operating on a small scale and it is basically under the energy social pillar for green and clean projects, such as solar energy, lighting and clean cooking energy. Specific products to address climate change, mitigation, and adaptation are limited. The aBi Finance Limited lends financial institutions instead of individual farmers. This helps to reduce administrative cost of lending by leveraging existing branch structures. However, aBi Finance Limited mostly targets Tier IV FIs (Micro-Finance Institutions) because of their ability to reach farmers at the grassroots (see Table A6) for example of green finance products being offered by banking institutions

It was found that the entry point to green finance is targeting the lower finance institutions, especially Tier III and IV, which are on the ground and can reach the smallholder farmers. Smallholder farmers at the production stage need resources for mitigation and adaptation because they are the most vulnerable to the impact of climate change. Box 1, highlights the support needed by financial institutions, especially Tier

Box 1: Key areas for green financing up-take in banking institutions

How can you best be supported to take up greening financing?

a) Banks need funds dedicated to green financing.
b) If tier III institutions are to be supported to mainstream green financing in their system then, sensitization and capacity building is paramount if uptake of green finance is to increase. This should be at different levels;
i. Bank management
ii. Technical staff, especially loan managers and implementers.
iii. The client, who is to receive and use it profitably and pay back
c) Technical support is needed to manage the green finance loans. Green finance is new and has its modalities; it needs a specific staff with particular skills and developing operation guiding frameworks
d) Support in educating the clients to embrace green financing is fundamental. Banks usually take on new products and forget to train the clients. People need to know what green financing is, its importance, and why they must embrace it. Both the bank and clients need to know the kind of activities that will be funded through green finance loans. This will enable the clients to make informed decisions.
e) The current green financing seems to be focused on only agriculture, yet this needs to be expanded to include mitigation, climate change, and adaptation.

What would be your recommendations for this?

a) There is a need to support financial institutions to categorize their products in terms of climate change, mitigation, and adaptation.
b) Reduce the interest rate of these loans since most target the smallholder farmers, who are a risk segment and therefore need to be targeted for green finance loans. These are mostly based in the rural, peri-urban areas and poor urban places.
c) Target more youth and women and have specific products developed for this category of people.
d) There is also a need to reduce the cost of funding. This cost of funding makes the loans very expensive.
e) In-depth research is critical to generate knowledge to develop impact-oriented green products. There is a need to engage in more research to understand the diverse clientele and what specific interventions are suitable for particular groups of people and regions.
f) Green financing should not be about just availing the loans to people; it calls for a holistic (all-inclusive) engagement not limited to aBi Finance Limited, the banks, local government- Ministry of Agriculture, NGO, CBOs to support the cause.
g) Need to critically assess the strategy of working with intermediaries, especially at the level of the banks. There seem to be many levels that may increase the cost of doing business and the impact will be felt the least by the beneficiary who is a smallholder farmer.

(Tier II Banking Institutions, 2023)

III and IV banks to develop green finance products, and eventually disburse loans, as identified by a bank with no green products.

4.8.2 Challenges in expanding green finance

Key informant interviews with financial institutions recount that on top of the knowledge gap in green financing, green financing competes with traditional loans. Consequently, institutions are worried about losing their client base, due to conflict of interest. Moreover, banks make profit by selling the traditional loans. aBi Finance Limited in its structured programs, need to examine this aspect because it can potentially negatively impact green loan uptake.

> *"The biggest challenge is losing out some of our clients. Green finance contradicts the client base we already have. Most of our clients, 80%, of them are in production. These mainly deal in selling charcoal, firewood, and many other products that may not qualify for funding under green financing…….these are products with a carbon foot-print……traditional loans selectivity is not based carbon footprint"* (Tier 1 Banking Institution, 2023).

While efforts towards commercialisation and expansion of green financing are being made, they are undermined by high administrative costs in reaching the underserved or remote areas. This requires multiple branches to reduce travel cost to urban centres for rural clients. In addition, the component of sensitization about the importance, and use green financing product has a cost implication.

> *"We give loans but also look at improving the livelihood of the client. We look at social economic prosperity of the people. Therefore, we have to sit with the client and understand their social status and how they can benefit from the equipment. We also look at whether they are in groups or individuals. This all takes time and cost"* (Tier 1 Banking Institution)

Furthermore, interviews with banking institution suggest that it is a protracted and costly process to introduce a new product in the banking system before having it approved. This is a problem because it calls for creating new positions which require new skill sets to run those loans. As such the process to recruit staff and training also has a cost and time implication on the side of banks and other financial institutions. In addition, banks anticipate to face challenges in terms of loan recovery as clients are not well educated about these types of loans and their conditions.

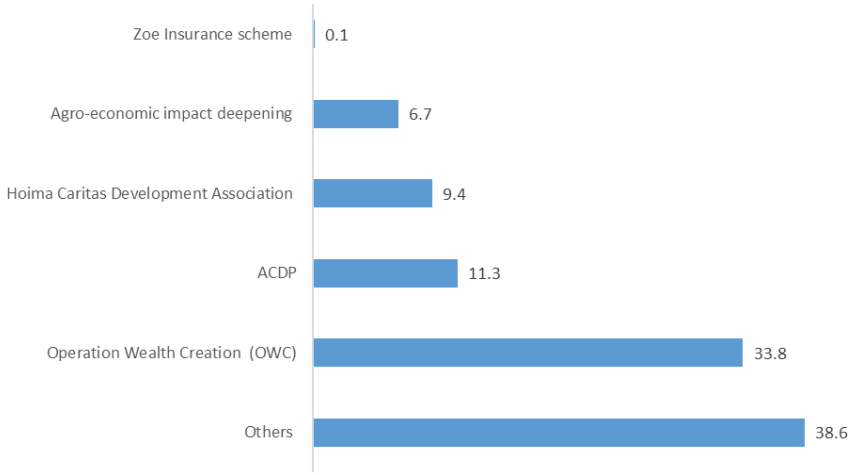
4.9 Past and Present Initiatives to Strengthen Linkages

The Government and other stakeholders have in the past and currently are implementing programmes meant to enhance inter-sectoral linkages. It is, therefore, essential to analyse the extent to which past and existing initiatives in the region support linkage creation or strengthening. Figure 23 suggests that OWC (33 percent) is the most visible government initiative perceived to enhance linkages. The rest, such as Hoima Caritas Development Organization, ACDP and Agro-economic Impact Deepening for the Albertine Basin Project (AIDA) are either cluster based or geographically limited in reach, largely benefiting the O&G region. For example, among these districts, the ACDP is implemented in Nwoya, Hoima, Rakai, and Mubende, facilitating rice, maize, beans, coffee and cassava production.[11] On the other hand, AIDA aims to improve the supply chain of agricultural goods and services to the O&G sector through building agricultural investment profiles, value addition and marketing in the Albertine region districts. AIDA, if effective, might connect a substantial number of oil firms' first and second-tier suppliers to value chain actors. Relatedly, the Hoima Caritas development organisation gives out soft loans for production to individual in the groups.

> *"We also give out irrigation kits to groups on credit. This is subsidized, the organization pays 20% and the group meets 80%. To date we have given out irrigation kits to 10 groups engaged in vegetable growing."* (Manager HOCADEO, 2022)

11 ACDP is operating in 12 clusters comprised of 57 districts. Nwoya is in cluster 6, Hoima-10, and Mubende-9. https://www.agriculture.go.ug/the-agriculture-cluster-development-project-acdp/

Figure 23 Past initiatives to strengthen linkages between agriculture and oil and gas (%)



Source: Survey (2022)

Therefore, these initiatives provide a platform to further enhance the linkages in the O&G region if implementation gaps are filled.

4.9.1 Initiatives by PAU in Collaboration with other Stakeholders

PAU, partners and Oil firms and contractors have implemented a number of agriculture related projects aimed at livelihood restoration and capacity building of agro-enterprises. Specifically, these project address critical aspects of the agricultural value chain such as skilling of farmers and enterprises in agri-business, agro-processing, access to technology, horticulture, post-harvest handling, and market linkages. The partners include African Development Bank, Stanbic Bank, MAAIF, UNOOC and Bunyoro Kitara Kingdom. The contractors include; Solid Rock, Conexus, while Oil companies are; CNOOC, TEPU and Tullow Oil. These projects are being implemented in both O&G and pipeline Regions targeting Project Affected Persons (PAPs), local business enterprises and local communities. These projects include; Albertine Enterprise Development Programme, Land acquisition, and Restoration programme, AfDB support to business linkages with EACOP, and the Agricultural Development Programme.

Box 2: Stanbic Incubator initiatives linking agriculture to O&G sector

Agriculture helps integrate marginalized persons such women and youth with O&G activities through the supply of food stuffs. However, these people lack the capacity in terms of resources, knowledge, skills, and land etc. There was need to form farmer groups to leverage on the economies of scale to improve quality and quantity of food supplied and access finance and financial literacy. However, farmer groups are affected by group dynamics such as poor leadership, political interference, dependency syndrome (sense of entitlement) and lack of business development support (financial literacy and record keeping etc.).

On the implementation side, there is lack of political will to scale agricultural enterprise incubation. There is a scope to improve the Parish Development Model (PDM) particularly in regard to outreach to farmers.

The incubator brought aggregators, with market expertise, on board to offer technical assistance regarding inputs, market linkages, land use management, introduction of horticulture etc. The incubator also introduced affordable irrigation kits to enables farmers plant crops throughout the year.

The emphasis on horticulture was intended to target export market through Kabaale airport. So far 500 farmers who are in farmer associations have been trained while others have been empowered to start their own incubators. The initiative has been supported with a funding of UGX 45 million from Uganda National Oil Company (UNOC), however there is room to increase this funding.
The incubator also promotes organic farming through training farmers in the use of organic manure, horticulture (fruits, vegetables). For sustainability, the incubator has identified community institutions such as churches, model farmers, and trainers perpetuate the idea of farming as a business. For example in Hoima, the incubator is working with Hoima Caritas Development Organization (HOCADEO) as a diocese program to recruit and support future agricultural enterprises.
(Stanbic Incubator 2023

During first phase of the survey, the study asked respondent to identify key initiatives implemented in their areas. Among those identified, OWC, AIDA and ACDP were the most prominent. However as earlier mentioned, most firms indicated the category "Others" which includes donor community and private sector led initiatives. For example, the Albertine Enterprise Development Programme implemented by Stanbic Incubator (Box 2) where firms are trained on how to participate and prequalify as food suppliers on the national suppliers database.

However, Agro-processers explain that;

"…there is a strong need for more trainings to focus on registration of farmers and how O&G actors could support food production through their associations" Agro-processers, (2022).

Efforts to mitigate constraints to community suppliers' participation are on-going through the Community Supplier Development Programme. Contractors have been hired to conduct the engagements with farmer groups and suppliers. In the engagements, females are given priority and are trained the supply processes.

"This year, we intend to train 250 youth and women in different fields- catering and hotel management and other trades to enable them to create their own jobs and businesses. After training they will be given starter kits… This is not Corporate Social Responsibility (CSR). This activity is under national content to ensure value retention in the country... We have linked the farmers, we train to aggregators, who also supply the other surplus to supermarkets and hotels" (Tier II contractor, 2023).

However, forming groups are not an end in attaining standards specifications. Farmers lack inputs like processors and refrigerators to help them meet the food standards demanded by the O&G sector. For example, HODEFA, an association of farmers in Hoima, could not meet deadlines for the supply of processed meat because they had to rely on an external meat processor. Therefore, there is need for integrating the supply chain actors to support compliance to standards.

4.9.2 The Adequacy of Initiatives being undertaken to Harness Linkages

Since visibility may not always mean adequacy, firms were asked whether the implementation of the programme was adequate to enhance linkages between oil and gas and the agriculture sector. Figure 24 suggests that the OWC and ACDP were viewed as very low and inadequate by more than 60 percent of firms in the pipeline region. However, more than one-quarter (27.5 percent) of firms in the O&G region ranked the adequacy of OWC and ACDP as moderate. This can be attributed to the fact that many surveyed firms are small to medium businesses with limited the requisite capacity to effectively tap into the linkages despite the implementation of government initiatives and inefficiencies in the implementation.

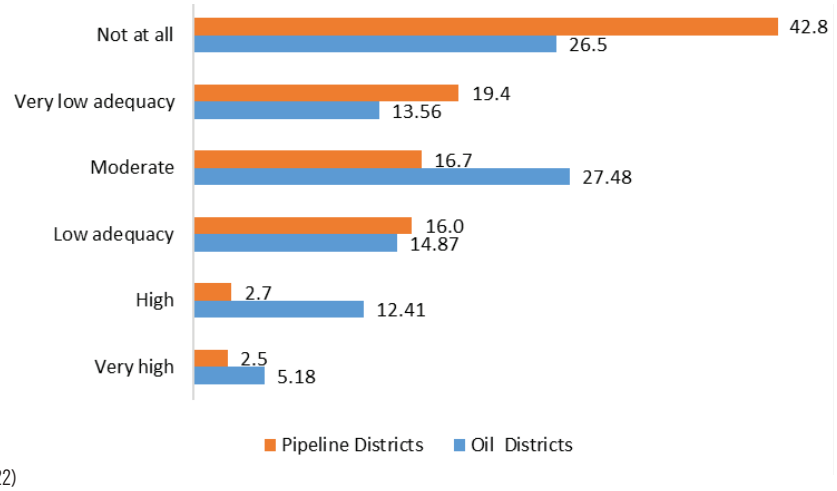
The low perceptions about the adequacy of initiatives in pipeline districts indicate that, unlike oil districts, investment in interventions or infrastructure targeting the oil and gas sector was late in the region. As a result, fewer activities on the ground further characterize them; therefore, linkages have not yet been harnessed. This suggests that an intensification of investments in initiatives to enhance linkages and implementation of the operations therein is necessary for the pipeline region. Similarly, investments that are spatially specific such as those in the Albertine Region, could spark production in the pipeline districts. However, respondents in pipeline noted that the low awareness of the impending construction of the EACOP in these districts is likely the reason enterprises have not leveraged the ongoing initiatives to strengthen linkages with the O&G sector.

4.9.3 The interventions required to ensure that linkages areharnessed

Critical among the intervention actions is advising on the standards needed for the different identified markets for agricultural produce and addressing the existing gaps in standards. For example, sharing information about milk quality determination can increase the quality of producers, in particular to the density of milk. A KII in Sembabule revealed that:

"We use a lactometer to measure the density of

Figure 24 Adequacy of initiatives implemented to harness linkages (%)



Source: Firm Survey (2022)

milk and can tell the Normal density of milk by is estimating it at 27.5, we also do an Alcohol test at 80% to estimate alcohol concentration for acidity determination of milk processors. How we do it is that we mix 2 millimeters of milk with alcohol and shake it and if it coagulates it enables us to know poor quality and reject it".

As earlier found, there is a fixation on produce weights as the hallmark of standards for other products like cereals, for which suppliers and producers have expressed the major reason for their failure to penetrate the food market in the oil and gas sector. However, there are other indicators of standards, sanitation, preparation and handling standards, and toxicity, among others. Under the National Local Content for the Petroleum Sub-Sector (2017), the role of MAAIF in the formulation of eventual enforcement of standards and laws and management of the agricultural development programs within the sector is defined.[12]

4.10 Long terms Impacts of the Oil and Gas Sector

4.10.1 Employment

Figure 25(A) suggests that the current sourcing of skills by firms is low in both the O&G (9 percent) and pipeline (7 percent) regions. For those who outsource labour, 35 and 43 percent of skills are obtained from outside the O&G and pipeline regions, respectively (Figure 25 (B)). This points to the characteristics of most of the firms surveyed. Most of the firms surveyed were micro, small and medium enterprises that rely on household or local labour, hence no incentive to outsource skills. Conversely, the enterprises that outsource labour are possibly foreign-owned, preferring foreign workers, or running advanced operations whose essential skillset is not readily available, regionally or nationally.

"Nevertheless, there has recently been an increased influx due to the discovery of Oil & Gas. People have been flocking to the region to tap into the opportunities the Oil &Gas industry presents, such as employment, business opportunities, and service delivery, to mention a few" Hotel owner in O&G region (2022).

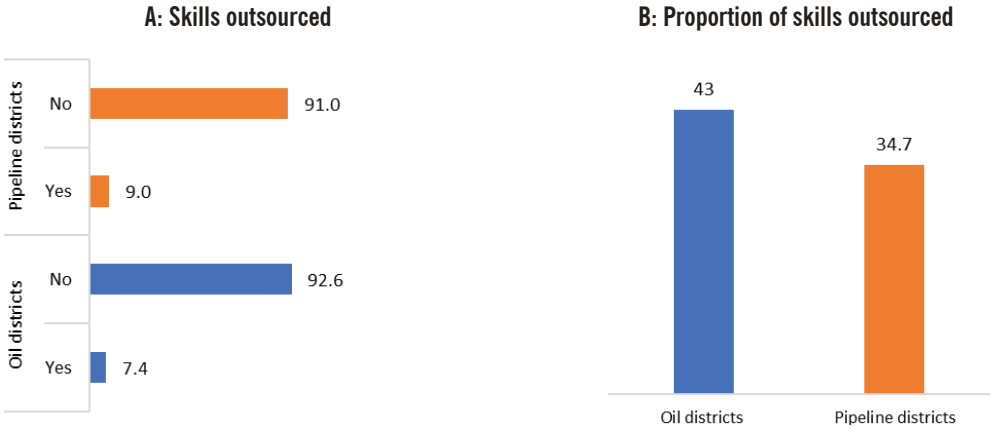
There is a scope to review the local content regulation to support local employment. For example, expatriate permits should be granted contingent on the absence of a qualified Ugandan. In addition, requirements to encourage licensee companies to skill Ugandans and transfer skills should be enhanced.[13] The NDP III also lays out strategies for building local capacity, promoting participation in the oil and gas sector, supporting local entrepreneurs, providing technical and vocational training to SMEs, and providing financial support (NPA, 2020).[14]

12 MEMD 2017. National Local Content for the Petroleum Sub-Sector Ministry of Energy and Mineral Development, Government of Uganda

13 Columbia Centre on Sustainable Investment (2021). Local Content – Uganda Petroleum

14 National Planning Authority. (2020). National Development Plan (2020/21 - 2024/25). National Planning Authority, Government of Uganda.

Figure 25 Skills outsourced and their proportions (%)



Source: Firm Survey (2022)

Table 8 Shift of labour across sectors

Region	Previous Sector	Percent
Oil districts	Agriculture	27.4
	Industry	5.9
	Services	41.4
	Previously unemployed	25.3
Pipeline districts	Agriculture	52.4
	Industry	5.8
	Services	20.0
	Previously unemployed	23.1

Source: Firm Survey (2022)

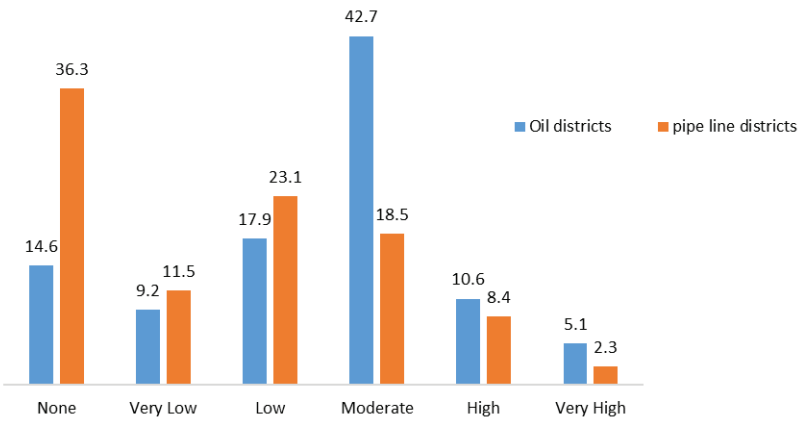
4.10.2 Shift of Labour from Agriculture

Table 8 analyses the shift of workers from the agriculture sector to secondary sectors, such as industry and services. From the table, there was a within-sector shift in the agricultural sector by 27 percent of workers moved to agriculture in the O&G region. This movement is more prominent in the pipeline districts, where 52 percent of employees are perceived to have joined the agricultural sector. In both regions, there is a shift of labour from other sectors to services, such as boda boda, salons, and catering, among others. The current low-value labour shifts within the agriculture sector from rural bases to O&G areas cannot contribute to long economic growth . These results emphasize deliberate efforts to strengthen the linkages to enhance the availability of industrial jobs and fast-track structural transformation.

4.10.3 Export Development

Figure 26 suggests that most firms in the pipeline region (36.3 percent) are pessimistic about the emergence of a sustainable export sector. Nevertheless, firms in the O&G region (43 percent) view the emergence of an export sector moderately. As mentioned earlier, favourable sentiments from the O&G region are expected since oil

Figure 26 Extent to which the oil and gas sector has impacted Export development (%)



Source: Firm Survey (2022)

activities have taken longer in those regions than their pipeline counterparts.

Firms were further asked what drivers could boost the development of an export sector. According to the survey, adherence to quality food standards is perceived the most important driver of export development in both the O&G and pipeline regions (Figure 27). Other critical drivers are roads, infrastructure, financing, networks.

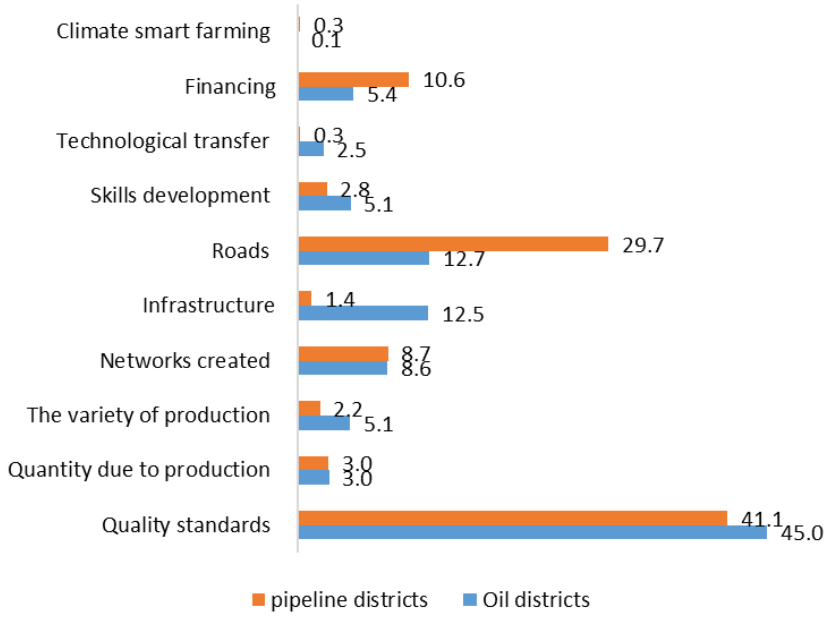
> *"Currently, planes are landing in Kabale industrial park to deliver oil and gas sector equipment and departing empty, yet high-quality produce can be exported using these planes." More was explained that "Hass avocado and fruits can be grown along the pipeline corridor and exported to China where it has a big market. This avocado can be used to manufacture oil that is used in hair products and puree or concentrates be produced out fruits for export,"* Opinion Leader from the pipeline region (2022).

5 CONCLUSION AND RECOMMENDATIONS

This study examines the potential linkages between O&G and the agricultural sector in the districts surrounding the Tilenga and Kingfisher Development Area Projects. These are Buliisa, Nwoya, Hoima and Kikuube districts. The study also focuses on the areas where the East African Crude Pipeline (EACOP) will traverse. These are the districts of Kakumiro, Kyankwanzi, Mubende, Gomba, Sembabule, Lwengo, Rakai and Kyotera. The study utilized a mixed method, which included the desk review, qualitative and quantitative methods. The quantitative analysis was based on the UNPS and the firm-level survey, while the qualitative analysis involved using KIIs and FGDs.

The linkages were based on activities undertaken at each sector's stage of the value chain. The study examined the inter-sectoral connection between activities and value chain actors. In addition, the study examined both the existing and potential linkages between service providers and recipients.

Figure 27 Drivers of export development (%)



Source: Firm Survey (2022)

5.1 CONCLUSION

The study concludes that households dominate the demand for every type of food compared to their firm counterparts. This suggest that there is a missing market for food supplies to firms. And households get food supplies from the farm gate. Therefore, there is a scope to increase the linkage between firms and the market. By region, the pipeline districts explain more than one-half of the food type demanded when compared with O&G region, which suggests that the combined population and socio-economic conditions of households in the pipeline districts are higher than those of O&G region.

Specifically, supply was higher than demand for cereals, pulses, vegetables & fruits in both the O&G and pipeline regions. The food demand and supply pattern in the O&G region suggest that there was a dominance of demand and supply of cereals relative to other commodities. Conversely, there is a dominance of the supply of vegetables and fruits in the pipeline region. This asymmetry in supply and demand creates an opportunity for trade between the pipeline and O&G regions.

In addition, the study found linkages between O&G and agriculture exist, but there is a scope for improvement. The existing linkages are much stronger in the O&G region because most of the primary investments have been ongoing in the O&G region for much longer than in the pipeline region. This suggests that activities in the pipeline region are still developing, and there is a scope to strengthen the adequacy of the initiatives undertaken to harness the linkages. However, the study establishes some ongoing initiatives, such as ACDP, OWC, and AIDA, to boost linkages; nonetheless, these projects are primarily visible in the O&G region.

The study found that the expected linkages in the O&G sector will improve income and infrastructure and alleviate poverty. However, the expected inter-sectoral shift of labour was less than desired. Most of the labour force was shifting to primary activities in the service and the agricultural sector. There were fewer employment opportunities in the industrial sector, encouraging the enhancement of secondary activities such as value addition, processing, and manufacturing.

There are several other crosscutting constraints to linkages. For example, the requirement to register on the NSD is constraining firms from tapping into linkages between the two sectors. Firms are expected to have a TIN and a URSB registration, among other requirements, to register on the NSD. Most of the firms in the two regions are registered with local governments and do not have the ability to register with URA and URSB.

It was observed that there is weak farmer organization due to a lack of coordination, variation in financing products, weak information-sharing mechanisms and evolving group dynamics. For example, the difference in age, gender, different income groups, motivation and product variation has shown to lead to conflict and disagreement in groups.

Most firms perceive weights as the most important attribute regarding standards. This could be a consequence of poor articulation of food standards required by the O&G sector. Other contributing factors that undermine standards among farmers include low-quality inputs that increase the toxicity of food products. In addition, poor storage facilities increase the rate of aflatoxins, mostly in cereals; and hurt prices, which disincentivises producers from complying with standards, among other requirements.

The study found a widespread lack of information regarding activities, requirements and opportunities offered by the O&G sector. The lack of information was found to be across the board and not only on standards-related issues. There were constraints on information on markets, market readiness, how agriculture works, inputs, and credit access, among others.

Comparatively, women face difficulties tapping into linkages between the two sectors because of several problems, including inappropriate technology, which requires manual power, lack of credit, cultural practices that impede women from owning land and entrapment in low-value primary activities.

Poor farming practices and changing weather patterns

endanger the two regions' agricultural systems. For example, livestock farmers were found to be substituting acaricides with herbicides associated with resistance to pests and diseases. In addition, encroachment of gazetted public land such as forests, game parks and swamps has contributed to the increasing human-animal conflict. Also, poor post-harvest handling methods have led to the loss of crop yield, produce spoilage, and low prices.

The agricultural systems in the two regions are vulnerable to weather changes, this affects the sector's ability to access financial services. In this case, financial service providers prefer to lend to the service sector as opposed to the agricultural sector on account of the higher risks experienced by the latter.

There is a wide knowledge gap on green- finance among potential clients at the grassroots and even financial institutions. Moreover, green financing competes with traditional loans. Consequently, institutions are worried about losing their client base, due to conflict of interest. Moreover, banks make profit by selling the traditional loans. There need to examine this aspect because it can potentially negatively impact green loan uptake.

Introduction of green-finance is costly because scaling it up to reach the underserved or remote areas involves exorbitant administrative and overhead costs. In addition, creation and implementation of green financing sensitization programmes has a cost implication. It's also costly to introduce a new product in the banking system before having it approved. Introducing a new product calls for creation of new positions, which require new skill sets.

5.2 Recommendations

1. Most businesses are small and registered with local governments. Such businesses lack the capacity to meet the pre-qualification required to register on the National Supplier DataBase (NSD). Therefore, the study recommends that government should recognise, digitalise and simplify intermediate and temporary legal status for firms' registration to ease small firms participation.
2. Inadequate articulation of the standards criteria for products required by O&G sector players, has constrained producers from meeting quality expectations. Therefore, to strengthen linkages, the O&G sector in collaboration with Uganda National Bureau of Standards (UNBS) should articulate and disseminate required food standards, to create awareness, which enables adaptation and implementation among local producers. This will leverage UNBS resources and capacity to enforce standards.
3. Poor farmer coordination and capacity has affected their ability to tap into and, benefit from the opportunities presented by the linkages. Yet farmer organisations are a platform for access to credit and support from government programmes such as ACDP, AIDA, Emyooga and Parish Development Model (PDM). Therefore, PAU in collaboration with local governments should support the creation of strong farmer organisations to enhance linkages and build complementarity, in disseminating information, technology, standards, access to credit, provision of extension services, market linkages, inputs, and coordination of farmers.
4. Inadequate infrastructure such as community feeder roads, storage and processing facilities and irrigation have affected the sufficient creation of linkages. Therefore, the local governments in collaboration with O&G sector players should maintain or upgrade community feeder roads in the two regions. In addition, both should facilitate farmer association at district level to set up and manage storage and processing facilities such; warehouses, abattoir and cold storage facilities. This will help maintain a stable food supply, export surpluses, improve food quality and stabilize prices.
5. Women and youth are critical in enhancing linkages between the O&G sector and agricultural value chain, but their participation is limited by access to credit, use of rudimentary farming practices and disenfranchising social norms. Therefore, financial institutions should design new products that cater to the economic vulnerability of both women and youth. In addition, the government should provide

appropriate technology to increase production and productivity. Further still, the government, community leaders and NGOs should conduct deliberate mass sensitization to uplift the status of the women and the youth.

6. Inadequate knowledge and affordability in adoption of climate-smart agriculture (CSA) practices, has affected the environment. Therefore, the key actors of O&G sector, environmental agencies and government should, in the short-run, integrate CSA practices to mitigate the impact of climate change. In the long-run, financial institutions and government should develop insurance markets and green financing products sensitive to agricultural systems to address losses related to crop failure. Relatedly, Government can go beyond regulating the insurance industry and benchmark the Kenyan model of public-private partnerships for agricultural insurance. In addition, there is a need for a deliberate effort to de-risk agriculture through the provision of fertilizers, pesticides, and irrigation.
7. There is need for holistic approach to increase awareness on green -financing. This should not be limited to financial institutions, but also extended to development organizations and research institutions to address the knowledge gap. In addition, there is need to develop specific products to address climate change, mitigation, and adaptation.

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APPENDICES

A. DETAILED METHODOLOGY OF THE STUDY

This section presents the analytical processes used in the study which included desk review of pertinent documents, and qualitative and quantitative research methods applied in the field. It also outlines justifications for and evaluation made of the key elements of the sector linkages and related variables, as well as the quality assurance mechanisms for the study.

A.1. Desk Review of Documents

The desk reviews were primarily undertaken to gather information for the development of the research survey tools, while various documents were examined to gain insight and understanding of the O&G and agriculture sectors. The documents reviewed include: national-level policies, plans, strategies and budgets; performance reports; and development literature related to the agriculture and O&G sectors. Key documents examined include the National Oil and Gas Policy for Uganda (2008); Vision 2040 and NDP III; the Agriculture Sector Strategic Plan (ASSP) for the period 2020/21 to 2024/25; the National Employment Policy (2011); and the National Local Content Policy for the Petroleum Sub-Sector (2017). Analysis was also made of the policy environment (or relevant policies) to determine the extent to which existing policies and strategies supported linkages between the two sectors.

From these reviews, interventions required to strengthen the various linkages between and within the agriculture and O&G sectors were identified. Bearing great importance in the study was the Agro-ecological Zoning Policy 2004 which details the agricultural commodities that can be suitably produced in the various geographical regions, and how production of the commodities can be scaled up through investments in the two sectors.

Relatedly, the NDP III was reviewed to gain understanding of the employment and infrastructural requirements needed to harness inter-sectoral linkages between agriculture and the O&G sector in the medium and long term. A comprehensive review was also made of existing programme and project documents, and evaluation, progress, monitoring, audit reports and other internal reports of the Petroleum Authority of Uganda (PAU) to assess the efforts already undertaken or being made by PAU to strengthen the two sector linkages. Similarly, past (since 2005/6) and on-going interventions targeting the O&G and pipeline Regions were also mapped out.

In order to benchmark with experiences elsewhere, the earlier mentioned research reports from Nigeria, Sao Tome and Iran, were reviewed to determine possible ways of creating linkages between O&G and the agriculture sector. Insights were also gained on the extent to which these countries were able to identify and implement interventions meant to strengthen linkages between the two sectors and with other related players.

A.2. Quantitative Methods

The methodology used in this section entailed descriptive analyses of the various Uganda National Panel Survey (UNPS) data collected by UBoS, and also the 2018 National Service Delivery Survey (NSDS) report. A firm (business) entity survey was also conducted in 2022 to generate information used to supplement the secondary data obtained from the desk reviews.

A.2.1. Secondary data sources

Uganda National Panel Survey (UNPS): Three waves of the UNPS report were analysed to identify potential linkages between agriculture and the O&G sector in the two oil Regions of the country by matching expected household food demand and supply.[15] As earlier noted, the O&G Region is an aggregation of the districts of Hoima, Buliisa, Nwoya, Kikuube, Kyankwanzi, Kakumiro and Hoima City, while the pipeline Region comprises the districts of Mubende, Rakai, Sembabule, Lwengo, Gomba and Kyotera.

During this study, agricultural commodities with the greatest potentials of generating linkages between the two sectors were identified. These were grouped into the broad categories of cereals, pulses and nuts, oil seeds, vegetables, Matooke and tubers, eggs, fish,

15 The three waves are 2005/06, 2013/14 and 2018/19.

meat, and milk and milk products.

The UNPS data were critical in determining the impacts of the O&G sector on the agricultural sector during the phases of oil exploration, development and production; with the three phases respectively synchronised with the three UNPS data waves of 2005/06, 2013/14 and 2018/19. The UNPS report was also used to estimate possible impacts of the two sectors on each other, and on the overall national economy. This entailed quantifying possible impacts of developing identified linkages on the economy, especially in terms of employment, sectoral shifts of labour, and exports.

National Service Delivery Survey (NSDS): The 2018 NSDS report was analysed to establish the interventions required to ensure that existing linkages between agriculture and the O&G sectors are harnessed. This was critical in measuring differences in agricultural service delivery between the O&G and pipeline Regions. The key indicators used to demonstrate the differences were the levels of usage of fertilisers and pesticides, that were the two key indicators in the 2018 NSDS report.

3.2.2. Primary data collection at the firm (business) level

As part of the study, a firm (business)-level survey was conducted in the O&G and pipeline Regions to establish institutional food demands, supply and linkages. A summary description of the firm characteristics and business parameters is presented in Table 1 (section 4). Key amongst the parameters were firm/business categories and sectors; ownership types; sexes and levels of education of firm owners and managers; years the firms have been in operation; skill levels of employees; and sources of skilled and unskilled workers.

Sampling frame: The firm-level survey was carried out to assess the institutional food demand, supply and linkages existing in the O&G and pipeline Regions. Initially, it was planned to use the National Supplier Database (NSD) that has list of firms (the sampling frame), but it was found that the oil Regions of registered firms were not given. Consequently, the sampling frame was constructed from the Integrated Revenue Administration System (IRAS), using a total of 15,728 firms from all districts in the O&G and pipeline Regions (Appendix T1). Mubende was excluded because of an outbreak of Ebola there at the time of the field study.

The sampling frame was constructed in a three-stage process. First, firms in tax and fees records of the local governments were extracted from the IRAS database for most urban districts; while records for most rural districts were obtained from manual tax files held by Sub-counties in the sample districts listed in Appendix T1. Second, names of registered cooperatives were obtained from district Commercial Officers and added to the firms compiled in the first stage. And lastly, extracts of key variables of interest, i.e. (i) names of firms, (ii) sectors, (iii) locations (ward, Parish, Sub-country, Municipality, City and District) and (iv) contact numbers of the business owners and the types of businesses, were then entered into the data set to complete the sampling frame (Appendix T1).

Sampling procedure: As a sampling strategy, a two-stage stratified sampling procedure was used where the Primary Sampling Unit (PSU) was the Oil Region while the Secondary Sampling Unit (SSU) was the sector (Appendix T1). The PSU was picked from Enumeration Areas in the twelve districts earlier identified, while the SSU were the sectors derived from agricultural activities. These were agri-services, agriculture production, agro-processing and other services (Appendix T1).

The two-stage stratified sampling method was used to randomly pick 1,000 agricultural-related firms from the 15,728 firms identified in the two Regions. This number took into consideration both sampling and non-sampling errors. Sector representation was also balanced, with each sector constituting not less than 20 percent and not more than 30 percent of the sample. This balancing was justified by the fact that the services sector had 13,933 firms, which number would have skewed the study towards services when the focal sector is agriculture.

During the survey 573 firms out of the total sample of 1,000 responded, which provided a response rate of 57.3 percent (Appendix T2). The relatively low response rate was probably due to some firms changing locations

and/or sector activities and many firms closing business, during 2020 and 2021, due to the COVID-19 pandemic. However, a low response rate is not unique to this study. The World Bank Enterprise Survey (WBES) of 2013, for example, had a response rate of 41 percent (World Bank, 2014); while an informal sector study by EPRC (2022) suggested a high firm failure rates, with few firms surviving beyond 5 years.

Nevertheless, disaggregation of the data in Appendix T2 suggested that relatively more firms in the agriculture sector were interviewed than those sampled, while there was a low response rate (9.4 percent) by firms in the agri-services sector. These two potential sources of bias were corrected by weighting before final analysis as shown in Appendix B1.

Survey questionnaire: To generate data on key linkage parameters, a structured questionnaire was also designed, pre-tested and administered during the field study. The parameters assessed were:

a) Demand or market for food at different value chain stages measured in terms of the levels of demand by firms. This was also used, in part, to identify agriculture-related enterprises with greatest potentials to build linkages with the O&G sector.
b) The degree of local sourcing of inputs by local suppliers or services firms, including the extent of backward and forward linkages.
c) Development of agro-manufacturing through linkages as well as services, and potentials from petrochemical industry development.
d) Supplier linkages at different levels (e.g., first-tier and second-tier suppliers).
e) Market linkages, as well as market and other relevant information exchange. At the market level, the survey examined the standards requirement by the different market segments or suppliers.
f) Financial linkages, including access to financial and non-financial agri-business and other business services.
g) Labour linkages between agriculture and O&G sectors, and extent of food supply support and gaps. Also explored were the potential of linkages to support agribusiness growth, green growth and climate-smart agriculture.
h) Long-term effects of oil exploration and related activities on agro-based livelihood activities; and on economic benefits, including firm growth prospects and financial opportunities arising from establishment of linkages.
i) Legacy aspects of the identified linkages, especially the long-term ability of supply capacities to be sustained by international markets when demand for oil and gas drop.

A.3 Qualitative Methods

To further examine and gain comprehensive appreciation of the linkages between agriculture and the O&G sector in the two study Regions, key informant interviews (KII) and focus group discussions (FGD) were undertaken to collect additional data covering districts, food value chain actors, the O&G sector, and other service providers (Appendix Table T3). Pre-coded and emerging themes were synthesized to enable generation of information to complement those obtained from the UNPS and NSDS analyses and the firm surveys carried out earlier.

A.3.1. Key Informant Interviews (KII)

Key informant interviews (KII) were conducted to further examine and appreciate the sector linkages. The key informants were purposively sampled to ensure adequate representation of the agricultural (production, processing and marketing) and O&G sectors (exploration, development and development) actors; and were grouped into four categories: (i) district officials; (ii) food value chain actors; (iii) the oil and gas sector players; and (iv) financial service providers (Appendix Table T3).

In each district, interviews were conducted with officials responsible for policy processes and agricultural extension and production services in order to ascertain food production and marketing capacities in the O&G and pipeline Regions. Those interviewed included district Commercial, Production and Extension, and Community Development Officers.

For food value chain actors, the interviews were conducted to establish the food production and supply value chain patterns in the two Regions. Examined

were the food supply constraints and gaps within the food systems; and the opportunities and challenges that affect food logistics, such as roads and access to relevant officials and how these inform policy and planning. The respondents included food aggregators (such as grain warehouses), processors, supermarkets, and institutional food consumers (Appendix Table A3). With respect to the O&G sector, focus was on food demand and consumption patterns of the players in the sector. Specifically, detailed information was gathered on food types, quantity and quantity requirements for the professionals and key actors employed in the sector. Focus was made on assessing the quality status and expectations of oil companies; the kinds of food demanded versus what are supplied by firms or farmers; and the types of food imported.[16][17] Other issues assessed included how the O&G sector can help address food system challenges related to quality and quantity.

Beyond the above specific areas, the interviews also examined the effects of existing agricultural related programmes, such as the Agro-economic Impact Deepening (AIDA), on the creation of linkages between the two sectors, and on the privately provided activities and services that also create linkages between the two sectors. Because most of these activities were co-delivered or supported by the Government, efforts were also made to identify the areas within the linkages that are supported by government, as well as the potential roles that government can play in creating or strengthening the various linkages.

Similarly, because regional initiatives were undertaken by the Government and non-government actors, or a combination through Public Private Partnerships (PPPs) as well as partnerships between government and Development Partners, analysis was also made of the extent to which regional and related initiatives were being used to support linkage creation or strengthening. The KIIs also explored perceptions of various stakeholders of the effects of the O&G sector on agriculture during the exploration and development stages, and their expectations of the same during the oil production phase.

A.3.2. Focus group discussions (FGD)

The focus group discussions (**FGD**s) were conducted with farmer associations and groups; food suppliers and produce traders disaggregated by size; seed suppliers and multipliers; agro-input dealers; food processors; hotels, restaurants, and supermarkets; and other value chain actors, with the purpose to establish the food production and consumption capacities in the two oil Regions. The FGDs also captured information regarding arable land for potential use; farm practices, including improved input use; food sorting, processing and packaging practices; storage and warehousing; and agri-financing in the two regions.[18]

Through the FGDs, assessment was also made of how the expectations of the oil companies were perceived by households and firms, and how O&G activities were impacting local economic development (LED) in various parts of the two Regions. The study also identified challenges related to pollution and Climate Change associated with O&G and agricultural sector activities and assessed how they are affecting food production and diversification. This enabled identification of strategies to mitigate possible adverse effects generated by different actors in the two sectors.

A.4 Food Demand and Supply for the O&G Sector

Food demand and supply speak to backward and forward linkages between agriculture and the O&G sector. With substantial planned investments in oil production in Uganda, it is expected that the O&G sector will generate huge demand for food and stimulate agricultural supply capacity growth to meet these demands.[19] It in particular, the O&G and pipeline activities will attract migrant skilled, unskilled, local and international workers who will bring with them varying food tastes, preferences and demands. This calls for readiness to improve supply and quality and standards, and local capacities to produce and supply food as required. Accordingly, assessment was made during the study of the types, quantities, qualities, sources, and motivation

16 Such as demand and supply of organic versus inorganic foods

17 Imported food can be processed versus unprocessed foods, organic and inorganic foods.

18 Inputs include fertilizer application, irrigation, and improved seed use.

19 Food includes cereal, meat, milk & milk products, fruits & vegetables, pulses & nuts, matooke & tubers, fish, and oils & eggs.

of food demanded and supplied in the O&G and pipeline districts.

A.4.1. Estimation of Food demand

Consumer demand for food is an important element of the linkages between the O&G and the agriculture sectors. For consumers, changes in food prices and per capita incomes are key determinants of the types and quantities of food demanded and purchased. Arising from the oil investments, per capita incomes in the two oil Regions are also expected to grow rapidly.

Estimates of consumer food demand reflect the effects of prices and total expenditures on food and inform on how consumers make food purchasing decisions. The estimates also help policy makers and implementers design and implement requisite interventions to strengthen critical linkages. From the various research processes, therefore, information was gathered on the food demand and supply situations in the O&G and pipeline Regions. Information was also gathered on the perception of households of the effects of the O&G sector on the agricultural sector in the oil Regions during the oil exploration and development stages.

A.4.2. Demand and supply linkages

Food demand and supply speak to backward and forward linkages between agriculture and the O&G sector. Given ongoing oil investments in the country, it is expected that the O&G and pipeline activities will attract migrant skilled, unskilled, local and international workers to the oil Regions, thereby producing huge food demands with varying tastes and preferences. This, in turn, is expected to stimulate Uganda's agricultural production and supply capacities to meet the increased food demand and preferences.[20]

With the O&G industry demand for specialized labour and projected influx of workers (both local and foreign) and service providers into the two oil Regions, and with outsourced foreign workers bringing unique food preferences, demand for a wide variety of food types is expected to increase dramatically. Accordingly, firms were asked to rank the likely preferences of outsourced labour for the food types mentioned earlier, including cereals, meat, pulses and nuts, milk and milk products, fruits and vegetables. In addition, assessment was made of the perception of local households of the impact of the O&G sector on agriculture during the oil exploration and development stages.

As demand for food increase and the variety of taste and preferences of O&G workers diversity, there will be urgent need to improve availability and local sourcing of food of diverse quantities (volumes) and qualities (standards). Information was therefore also gathered on the sources, quantities and quality of food, and motivations of food demand and supply in the O&G and pipeline districts. Using a Monte-Carlo simulation, 5 and 10-year projections were also made of the anticipated levels of food demand and supply for the two oil Regions.[21] The projections will help guide policies and planning.

3.4.3. Assessment of food standards

Given that the unique food tastes and preferences of outsourced labour calls for observation of food standards that meet their expectations, stakeholder firms were interviewed to rank desirable food attributes and standards. Using order of importance, the attributes the firms ranked for the various foods mentioned above included freshness, weights, toxicity, organicity, non-organicity, traceability, handling, and sanitary/quality standards and compliance therewith; and initiatives for improvement. The information gathered is intended to inform strategies for strengthening local production and sourcing of food for the O&G sector.

A.5. Sources of Food for the O&G Sector and Other Entities

It is a basic fact that, in the O&G sector, outsourced labour is always very diverse and come with their own food tastes, preferences and standards that must be met to address their expectations. This study therefore

20 Food includes cereal, meat, milk & milk products, fruits & vegetables, pulses & nuts, matooke & tubers, fish, and oils & eggs.

21 In forecasting future volumes, we take the following steps; First, we calculate the mean and variance of the change volume by crop based on historic data through year t. We forecast volumes by 5 (Production Phase I) and 10 years (Production Phase II) into the future. The forecasts are generated with repeated random draws from a normal distribution, with drift and variance equal to the one that we earlier generated in the previous steps. We simulate 50 different forecasts of the future for each crop category. For example, to calculate a volume for the year 2020, we forecast 50 different crop volume paths for volume in the years 2020 to 2030. In the last step, we take averages across the volumes from the 50 different paths to determine the expected Volume for each of the crop categories.

interrogated oil firms on their food needs and requisite standards, including weights, toxicity, organicity and non-organicity, among others.

While critically required foods may be imported, local sourcing of food is essential for cutting cost, building food security and ensuring viability of investments in food production and supply. Oil companies, PAU and other stakeholders have identified linkage areas that can be serviced by local suppliers, with 16 service areas being mostly food supply related.[22] Accordingly, inquiries were also made to generate additional information on the food demand and supply situations in the O&G and Pipeline districts.

A.5.1. Local sourcing of food and impediments encountered

During the key informant interviews (KIIs), O&G contractors were asked about the sources of food supplied to them; the suppliers or agents; the extent to which the various food items were locally produced; requisite standards at procurement; and the share of expenditure on food against total firm expenditures. District officials were also interrogated on local farmer practices and capacities; and on factors influencing demand, supply and acceptance of locally produced foods.

During the interviews, information was also gathered on factors that are impeding local food production, including land access and holdings, production practices, and post-harvest handling and processing of foods. Impediments to purchase of local foods in the O&G and Pipeline Regions were also assessed, with focus on food quality and prices, and ease of market access.

A.6. Linkages between Agriculture and the O&G Sector

Beyond the know basic linkage of food demand and supply between agriculture and the O&G sector, investments in oil exploration and extraction have led to a diversity of direct and indirect linkages between and within the two sectors. The direct linkages include provision of agricultural inputs and technologies by the O&G players, and agricultural support services (extension, technical advisory etc.) by key stakeholders.

Conversely, indirect linkages represent the interconnectedness of first-tier and second-tier suppliers in the O&G sector; with first-tier suppliers offering services to the O&G companies, while the second-tier suppliers provide materials, inputs, catering services etc. to the first-tier suppliers. In exploring linkages between agriculture and the O&G sector, therefore, the areas of critical interest include the existence, modes and strengths of the linkages, the value chain actors, opportunities available, and constraints to the linkages.

As O&G sector activities deepen, the number and types of linkages and exchanges between agriculture and the sector will expand, with increased need for specialized food production and marketing services, including standards control, grading, storage and packaging, processing and manufacturing, and market information dissemination. This study therefore also inquired on the linkage awareness of the various stakeholders, linkage opportunities, and the challenges constraining the tapping of the various linkages between agriculture and the O&G sector.

A.6.1. Stakeholder perception of linkages

During the interviews, various stakeholders were also asked on their awareness of the linkages between agriculture and the O&G sector in the two oil Regions; the nature and modes of the linkages, particularly whether primary or secondary; and the value chain actors and key players in the linkages. They were also asked about their perceived prospects for linkage growth in light of the looming investments in the oil extraction and refining phases.

A.6.2. Linkage support by Government, PAU and stakeholders

Also inquired into during the surveys were the actors and activities in the two oil Regions with the strongest linkages between agriculture and the O&G sectors; their key activities and impacts; and the ways the impacts of the actors and their activities are being maximized. In this regard, respondents were asked of their knowledge of the interventions Government, Petroleum Authority

22 The 16 supply areas are in goods, works and services

of Uganda (PAU), development agencies and partners and other stakeholders have made to support the agriculture and O&G sector linkages, and linkage actors and activities.

A.7. Linkage Constraints and Linkage Enhancement

Food consumption is rarely a simple connection between farmers and consumers but involves a range of service providers who participate in the food value chain- from production to consumption. These service entities, including input and advisory service providers, wholesalers and retailers, agro-processors and manufacturers, and financial service providers, are located in various places and are of diverse socioeconomic scales, and with many even unaware of the activities of other co-players. To understand and help support the growth and success of these entities, a critical review was made of the constraints and challenges they face.

And given the need to strengthen the agricultural value chain actors and their capacities to ensure availability of desired food for O&G workers and other stakeholders, particularly in the emerging oil production and processing phases, assessment was also made of the key factors constraining linkages between agriculture and O&G sectors, and the interventions and initiatives required to develop food value chains and strengthen the linkages. The particular areas of focus included input and knowledge support; production, handling and processing; financing and credit provision; and adaptation mechanisms and strategic interventions in the face of Climate Change.

A.7.1. Agri-input and advisory support

Coordination and improvement of farmer activities are key to leveraging the opportunities that emanate from linkages between agriculture and the O&G sector. This calls for support to farmers, farmer groups and agricultural value-chain actors to build capacities and competitiveness to enable them to tap the opportunities emerging from the O&G sector growth. Critical to this is access to requisite agro-inputs and effective extension and advisory support services.

Of equal importance is the challenge of service provision and input supply networks that ensure effective food production and building of strong linkages between agriculture and the O&G sector. In this regard, challenges of access to key inputs, such as fertilizers, pesticides, improved seeds, and farm machinery at household and farm levels in the O&G and Pipeline Regions, needed to be critically determined.

Based on the above, interviews and focus group discussions were held with key stakeholders to ascertain the interventions being provided to agriculture as linkages to the O&G sector, including enterprise development, inputs, group mobilization, training, extension and advisory support. Also assessed were the levels of support provided by key stakeholders, particularly Government, PAU, districts and major financial entities (Stanbic, aBi Finance Limited etc.).

A.7.2. Production, marketing, processing and manufacturing

Consumers purchase food directly from farmers and food markets, or from supply, wholesale and retail firms that deal in bulk purchases. The food preferences of consumers are also informed by factors, such as distance, taste, durability and prices. As an ultimate strategy for developing effective linkages between agriculture and the O&G sector, focus in the medium term should shift from basic production to high value production and processing of quality foods, with agro-manufacturing as the pinnacle. Linked to these are the challenges of financing, transport, value-chain development, standardization, quality control, and building competitiveness.

In the interviews and stakeholder engagements, therefore, enquiries were made on stakeholder awareness of the above challenges; and on whether Government, the O&G sector and other stakeholders have invested in addressing the challenges and the linkages focused on.

A.7.3. Agri-credit and financial services

In supporting the food value-chain actors and products in the two oil Regions to enhance the linkages between agriculture and the O&G sector, Government, PAU and other stakeholders have been providing limited financial assistance that has generated poor progress. In light of the emerging need for supply of quality food

to the growing O&G sector, other associated entities, banks, microfinance institutions and institutional investors need to undertake the requisite financing that will trigger desired transformation in the agricultural value chain.

To appreciate and address the financial constraints faced by the linkage actors, the various linkage actors in the agriculture value chain were asked about the financial support they have been receiving, and the key factors constraining their access to needed finance. The study also sought to understand these challenges from the entities now leveraging financial services support in the oil Regions.

A.7.4. Climate-smart agriculture and green-financing

Climate-smart agriculture (CSA) is an integrated strategy for managing agricultural lands and activities to mitigate the challenge of increasing adverse effects of Climate Change in food production.[23] As the O&G sector builds stronger linkages with agriculture, it is critical that the linkages are made resilient and sensitive to environmental degradation and climate effects, and this requires solid policy stances and effective financial support. As part of this study, therefore, assessment was made of the O&G sector support for climate-smart agriculture development, and stakeholder firms were assessed on the extent of this support.

Under the Paris Climate Accord, concessional financing, largely known as "green financing", has been put together to help countries address the challenges of Climate Change. Uganda is a beneficiary of this financing mechanism that can help fund the desired transformation of our agricultural value chains; and aBi Finance Limited is leading the enhancing of green financing among financial institutions in the country.
Given that green financing is new, and many Financial Institutions (FIs) and businesses have little knowledge of the concept of "going green", the Tier I, II, II, and IV financial institutions and other linkage actors in the two oil Regions were interrogated on their awareness and participation in the green financing initiatives; the extent to which they have tapped this finance sources; the challenges the initiative face; and their suggestions on how the initiative can be strengthened to support the transformation of the agriculture sector in the two oil Regions.

23 World Bank. (2023). Climate-Smart Agriculture. https://www.worldbank.org/en/topic/climate-smart-agriculture

A.8. Long-term Impacts of the O&G Sector

Beyond current investments and business activities related to the oil exploration and exploitation phases, Uganda has also put in place concrete plans to establish its own crude oil refinery in Hoima.[24] Once built, the refinery is expected to attract petro-chemical industries that will utilize bi-products from the refinery, and from other fossil fuel sources such as coal and natural gas.[25] Once implemented, these investments are expected to create jobs and enhance employment opportunities; trigger shifts in labour especially away from agriculture; and to spur growth in exports and general transformation of the economy.

Accordingly, the study surveys also assessed the levels of stakeholder awareness of the huge potentials ahead, and the readiness of firms to tap the opportunities that will emerge from the projected O&G investments. Because these activities can impact economic development in both positive and negative ways, and directly or indirectly, it was also pertinent to identify the pathways by which the O&G sector investments may impact economic development, and the expected outcomes, opportunities and challenges (infrastructure, skills etc.) that will arise.

A.8.1. Employment creation and enhancement

It is expected that linkages arising from the oil investments will generate opportunities for skilled and unskilled workers, both within and outside the O&G and Pipeline Regions. The study therefore attempted to measure the likely scale of labour outsourcing with increased investment in the O&G sector by examining the current proportion of skills, and/or skilled workers outsourced from the outside the two oil Regions or the country, and how employment for locals and nationals in the O&G sector and associated entities can be

24 Such as olefins and aromatics by fluid catalytic cracking of petroleum fractions

25 The two most common petrochemical classes are olefins (including ethylene and propylene) and aromatics (including benzene, toluene and xylene isomers)

enhanced.

A.8.2. Labour shift from agriculture to other sectors

As noted during the two stages of oil exploration in Uganda, investments in the O&G sector impose sector demands for non-skilled, skilled and specialized labour. The investments, in turn, attract food supply and other agricultural service entities and service firms that also create employment opportunities. It is also envisaged that as the O&G activities advance, the linkages between agriculture and the O&G sector will foster shifts in labour from low- to high-value agricultural investments and also attract industries and service firms that seek to tap emerging opportunities both within and outside the O&G sector.

As witnessed in other countries (Klueh *et al*., 2014; Fathi, 2014; and PWC, 2018), expansion in O&G investments and resultant diverse activities tend to also attract speculative businesses and labour drawn from other parts of the country. Like urbanization, this attraction also draws unskilled labour away from agriculture and rural life to the O&G Regions and to oil related urban centres where such labour pays better.
To gain insight into the impacts of increased O&G investments on linkages to agriculture, and on business diversification and resultant shifts in sectoral labour, particularly away from traditional agriculture, the surveys and focus group discussions were used to probe the awareness of various stakeholders of the expected intra- and inter-sectoral labour shifts with increased O&G investments. Analysis was also made of the anticipated sectoral reallocation of employment across sectors in the period.

A.8.3. Export growth and economic development

It is considered that linkages between agriculture and the O&G sector will ultimately generate surpluses in food and animal products supply, driven by investments in improved production, processing, value addition, and climate-smart agriculture. It is also envisaged that the gains made from agricultural linkages to the O&G sector will lead to buildup of inherent capacities, competitiveness and availability of surpluses for regional and international exports. This will support effective and sustainable use of the key infrastructure developed for the O&G, particularly tarmacked road network and airport.

During the study, therefore, firms and stakeholders were further asked about their perception of the emergence of business activities and agro-export that will result from increased investments in the O&G sector. An attempt was also made to profile the impacts of these developments on the general economic wellbeing of the country.

Appendix T1: Firm population

Region	District code	Districts	Agric Service	Agriculture	Agro-processing	Services	Total
OG region	1	Buliisa	0	2	2	284	288
	2	Hoima City	191	56	69	3,989	4,305
	3	Hoima	27	42	36	1,942	2,047
	4	KiKuube	0	225	0	0	225
	5	Nwoya	8	57	2	41	108
Pipeline region	6	Gomba	2	107	3	169	281
	7	Kakumiro	211	120	134	5,809	6,274
	8	Kyakwanzi	24	20	36	1,574	1,654
	9	Kyotera	0	81	138	30	249
	10	Lwengo	0	72	2	76	150
	11	Rakai	0	23	68	19	110
	12	Sembabule	3	23	11	0	37
		Total	**466**	**828**	**501**	**13,933**	**15,728**

Firm Survey (2022)

Appendix T2: Sample and response rate of firms

Sector	Agriculture	Agri-services	Agro-processing	Services	Total interviewed	Total sample
OG	101	15	31	107	254	412
Pipeline	138	8	89	84	319	588
Total interviewed	239	23	120	191	573	
Total sample	**237**	**244**	**238**	**281**		**1000**

Source: Firm Survey (2022)

Appendix B1: Calculation of sample probabilities and weights

Based on the stratified two-stage sample design, the probability of selection for the sample firm within a sample enumeration area (EA) was expressed as follows:[1]

$$p_{hi} = \frac{n_h \times M_{hi}}{M_h} \times \frac{m_{hi}}{M'_{hi}} \ ,$$

where:

p_{hi} = probability of selection for the sample firm in the i^{th} sample PSU in the stratum (ward, parish, sub-country, municipality, city and district)

n_h = number of sample PSUs selected in stratum h for the survey

M_{hi} = total number of firms in the frame for the i^{th} sample PSU in stratum h

M_h = total number of firms in the sampling frame for stratum h

m_{hi} = number of sample firms selected in the i^{th} sample PSU in stratum h

M'_{hi} = total number of firms listed in the i^{th} sample PSU in stratum h

The basic sampling weights, or expansion factors, are calculated as the inverse of these probabilities of selection. Based on the previous expressions for the probabilities, the weights for the sample firms can be calculated as follows:

$$W_{hi} = \frac{M_h \times M'_{hi}}{n_h \times M_{hi} \times m_{hi}}$$

Where:

W_{hi} = basic weight for the sample firms in the i^{th} sample PSU of stratum h

1 M'hi is different for migrant and non-migrant households within each EA

Appendix T3: Coverage of the FGDs and KIIs

Level	Key informant interviews	Focus Group Discussion
District	• District Commercial Officers • District Production Officer • Extension workers • Community Development Officers (CDOs) • NGOs supporting the agriculture sector	
Food value chain	• At least 3 raw food suppliers / produce traders disaggregated by size (1 Large, 1 Medium, 1 Small). • Seed suppliers/multipliers • Agro-input dealers per district • 3 food processors per district • At least 2 - 5 hotels per district • At least 3 restaurants per district (1 Large, 1 Medium, 1 Small) • At Least 2 supermarkets per district • 1 Hotel Owners Association • 1 Food transporter per district • Institutional consumers; Schools - 1 secondary school and 1 primary school per district (1 public, and 1 private)	2 Farmer Groups per district
Oil and Gas sector	• Food quality inspectors (hired by oil companies) • All the operational oil companies (CNOOC, TOTAL) • 1 Food caterer hired by per oil company	
Other KII participants	• Financial services providers	

Source: EPRC's own construct

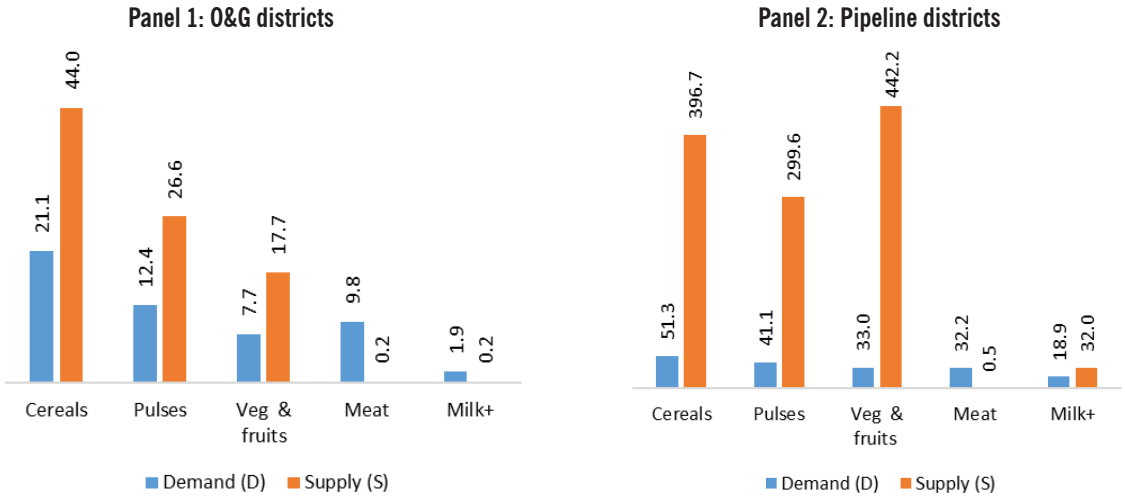
Appendix T4: The annual food demand and supply during the different stages of the O&G value chain (UGX Billions)

Stage	Region		Cereals	Pulses	Veg & fruits	Meat	Milk+	Total
Exploration I	O&G	Demand (D)	21.1	12.4	7.7	9.8	1.9	52.9
		Supply (S)	44.0	26.6	17.7	0.2	0.2	88.7
	Pipeline	Demand (D)	51.3	41.1	33.0	32.2	18.9	176.5
		Supply (S)	396.7	299.6	442.2	0.5	32.0	1,170.9
Exploration II	O&G	Demand (D)	76.9	85.9	76.8	71.0	25.9	336.5
		Supply (S)	124.0	218.6	33.8	0.1	13.4	389.9
	Pipeline	Demand (D)	328.0	249.1	284.0	323.0	165.0	1,349.1
		Supply (S)	1,840.8	1,599.2	575.7	0.4	86.7	4,102.7
Development	O&G	Demand (D)	152.0	121.0	83.4	163.0	53.0	572.4
		Supply (S)	354.9	327.7	91.8	25.0	0.3	799.7
	Pipeline	Demand (D)	405.0	291.0	169.0	507.0	217.0	1,589.0
		Supply (S)	990.3	916.2	352.2	37.1	168.6	2,464.3

Appendix T5: The food requirements for the labour sourced by region and commodity (%)

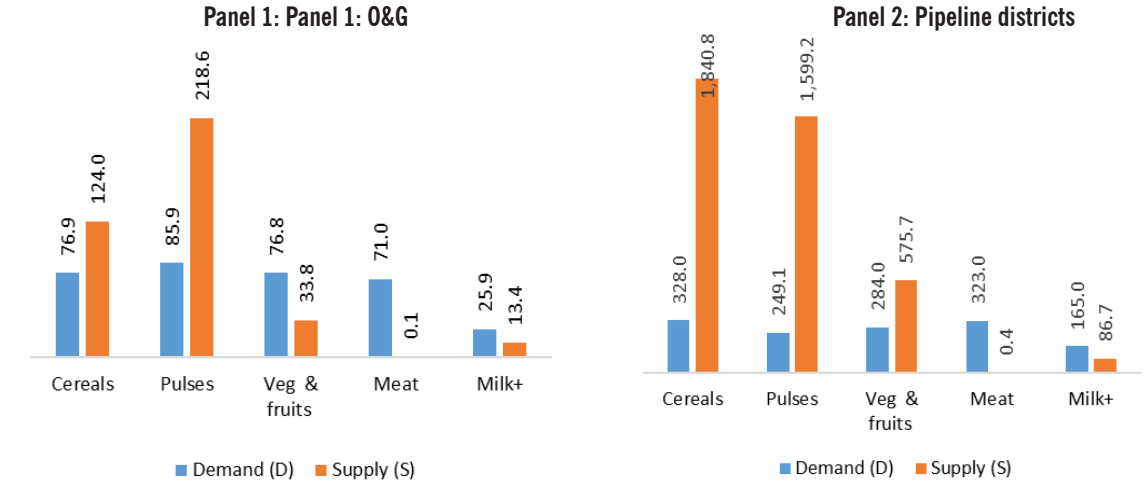
Expectations	Cereals	Pulses	Vegs And Fruits	Fruits	Meat	Fish	Chicken	Eggs	Milk	Oil
Panel A: Oil districts										
Greatly decreasing	0.1	4	0	0	0.1	0.15	0.05	0.05	0	0.04
Somewhat/moderately decreasing	3.7	25	1.4	2.44	4.8	3.68	0.05	4.96	2.43	7.17
Somewhat/moderately increasing	18	19	17.8	9.25	16.7	11.46	12.53	11.32	14.07	7.99
Greatly increasing	27	40	14.4	19.18	23.2	17.44	13.93	18.3	18.1	13.21
Remain the same	32	12	52.3	53.35	40.8	48.79	52.74	50.57	48.58	51.15
I don't know	19	-	14.2	15.78	14.4	18.49	20.7	14.8	16.83	20.44
Panel B: Pipeline districts										
Greatly decreasing	0.2	0	0.0	0.14	0.0	0.0	1.9	0.0	0.0	0.0
Somewhat/moderately decreasing	7.99	7	7.72	3.85	2.12	2.02	3.92	1.86	0.14	4.28
Somewhat/moderately increasing	25.18	22	21.07	16.42	15.28	14.33	10.54	12.64	19.14	15.12
Greatly increasing	12.56	14	11.57	7.7	16.31	4.34	6.18	11.85	8.6	4.34
Remain the same	48.35	54	55.59	60.22	56.41	63.09	66.38	62.89	59.64	65.7
I don't know	5.76	4	4.05	11.67	9.89	16.23	11.08	10.76	12.48	10.56

Appendix F1: The Exploration stage 1 of the O&G activities (2005-2012) (UGX Billions)



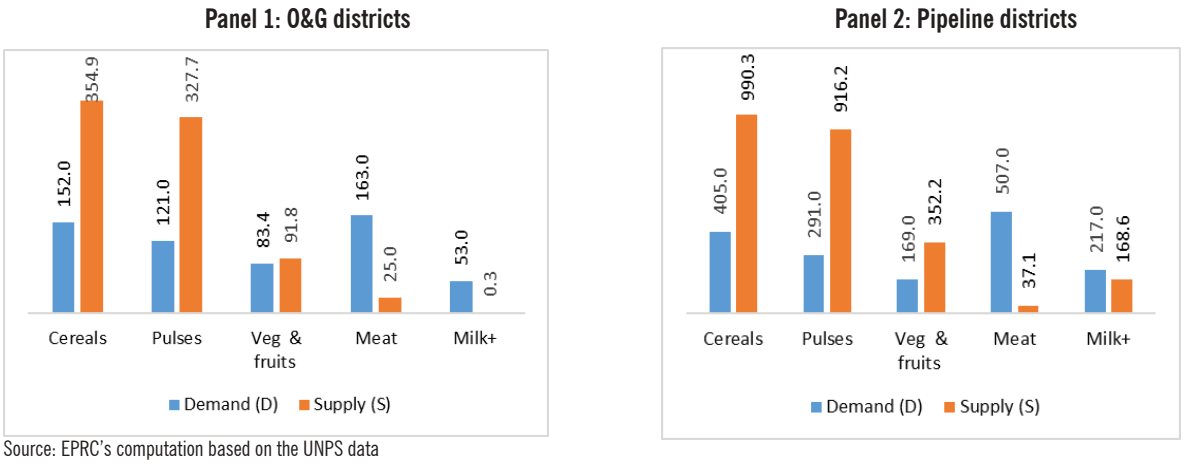
Source: EPRC's computation based on the UNPS data

Appendix F2: The Exploration stage 2 of the O&G activities 2013-2018 (UGX Billions)



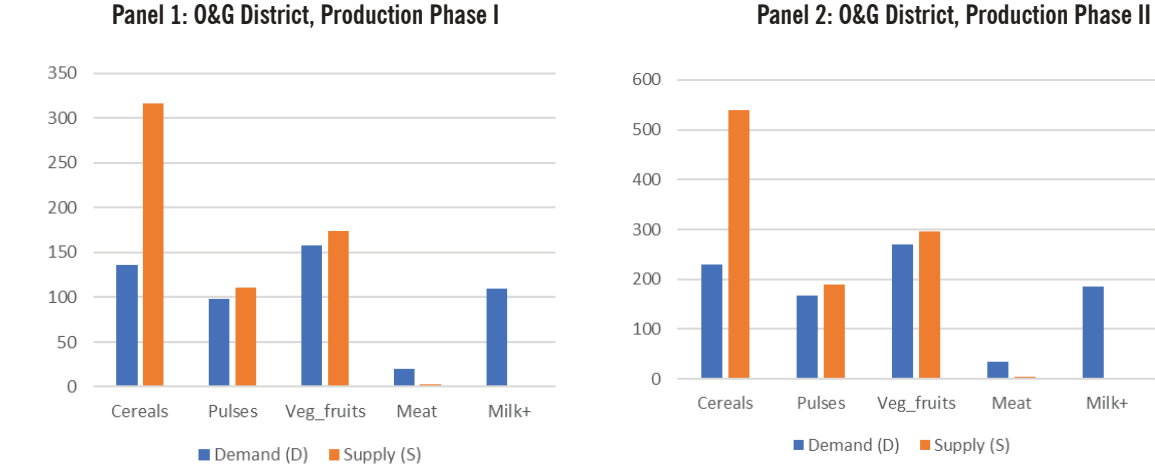
Source: EPRC's computation based on the UNPS data

Appendix F3: Development stage of the O&G activities 2018-2020 (UGX Billions)

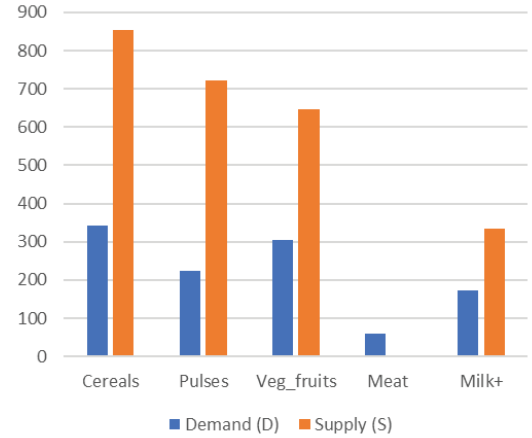


Source: EPRC's computation based on the UNPS data

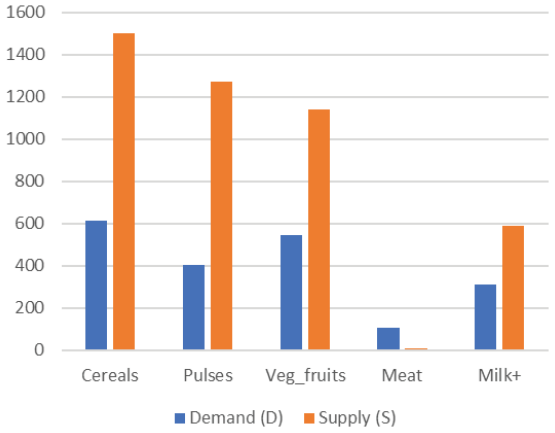
Appendix F4: Projection of Production stage of O&G activities 2021-2030 (000 MT)



Panel 3: Pipeline Districts, Production Phase I



Panel 4: Pipeline Districts, Production Phase II



Source: EPRC's computation based on the UNPS data

	Institution name	Product Name	Product description	Eligibility	Interests, Equity, and grace period	Targets/ Financial institutions	Credit Guarantees	Additional support	Partners
1	aBi Finance Limited	**Green lines of credit**	Lend to financial institutions. (FIs)	Financial institutions must have 3% of its portfolio dedicated to agriculture lending to green agribusiness	• Banking institution to own lend to their clients at their terms • Green loans are advanced at a lower interest rate averaged 16% per annum compared to the conventional loans	Financial institution Tiers 1 to 4 but mostly Tier 4	Currently it is 50 50. However, this will be revised in the next strategic plan to 70%. 50 to 50 rate. In this future strategic plan, we intend to increase it to 70-30	✓ Train management, Board, and loan officers. ✓ Support physical setup. ✓ Support product development ✓ Risk management ✓ Digital monitoring ✓ Installation of system to support repayment of green loans.	EU, Investment Fund for Developing Countries (IFU) Denmark, RDU, GOU, BOU, MoFPED, MAAIF, MOWE, Global Green Growth Institute (GGGI), Uganda bank associations, The Association of Microfinance Institutions of Uganda (AMFIU)
		Green guarantees:	This product helps FIs to de-risk when lending green loans to their clients		We give them three years for the repayment of these loans.	We enable financial institutions to give out more agricultural loans since they are viewed as risky by most conventional lenders			
		Financial services development for greening:	capacity, or system development, putting up structures, product development, and others		What is your average- it is 1.3% per month, and for other banks, it is 1%. 16%. Though it looks high, it is fair compared to average rates.	Tier III and IV because they are the most vulnerable and don't have robust systems			

	Institution name	Product Name	Product description	Eligibility	Interests, Equity, and grace period	Targets/ Financial institutions	Credit Guarantees	Additional support	Partners
2	Equity Bank	Equi-green loan	These loans target green project which may include but not limited agriculture	All types of green projects from agriculture, energy	Negotiable	All types of green projects from agriculture, energy	Risk shared with partners and the rate of risk sharing differs from partner to partner	provide technical advice, financial literacy & product development	aBi Finance Limited , International Fund For Agricultural Development (IFAD), International Finance Corporation (IFC), United Nations Capital Development Fund (UNCDF), SACCOS, cooperatives associations

Appendix T9: Product categorization of available Green Finance Loans

Economic Policy Research Centre
Plot 51, Pool Road, Makerere University Campus
P.O. Box 7841, Kampala, Uganda
Tel: +256-414-541023/4, Fax: +256-414-541022
Email: eprc@eprc.or.ug, Web: www.eprc.or.ug